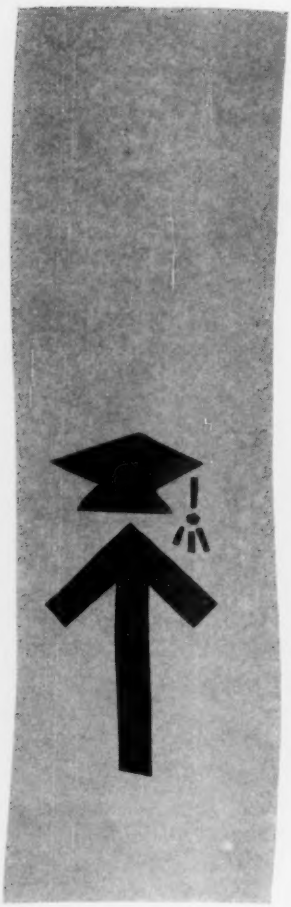
The Magazine of the Registered Professional Engineer

American Engineer

MARCH 1960



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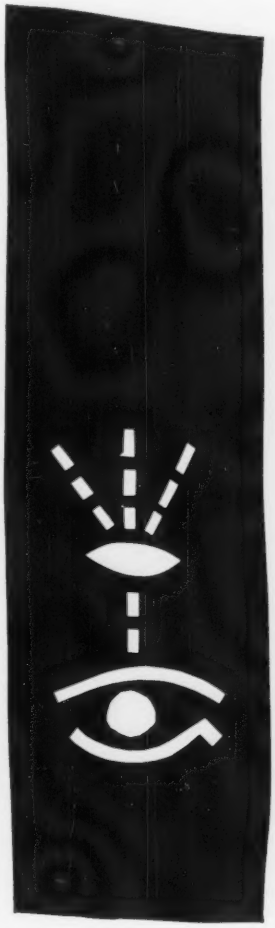

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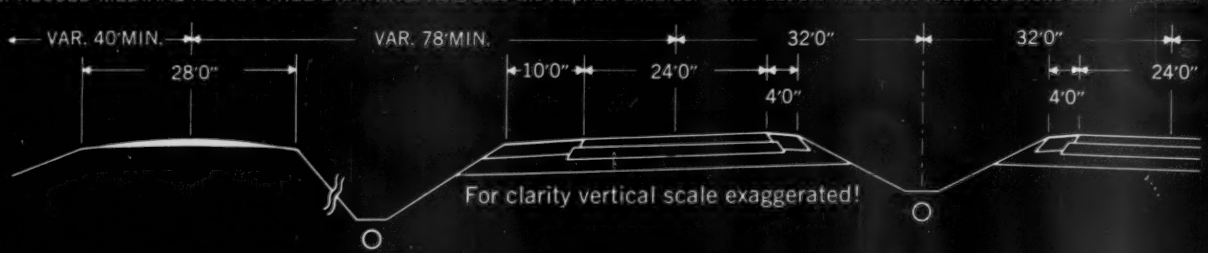

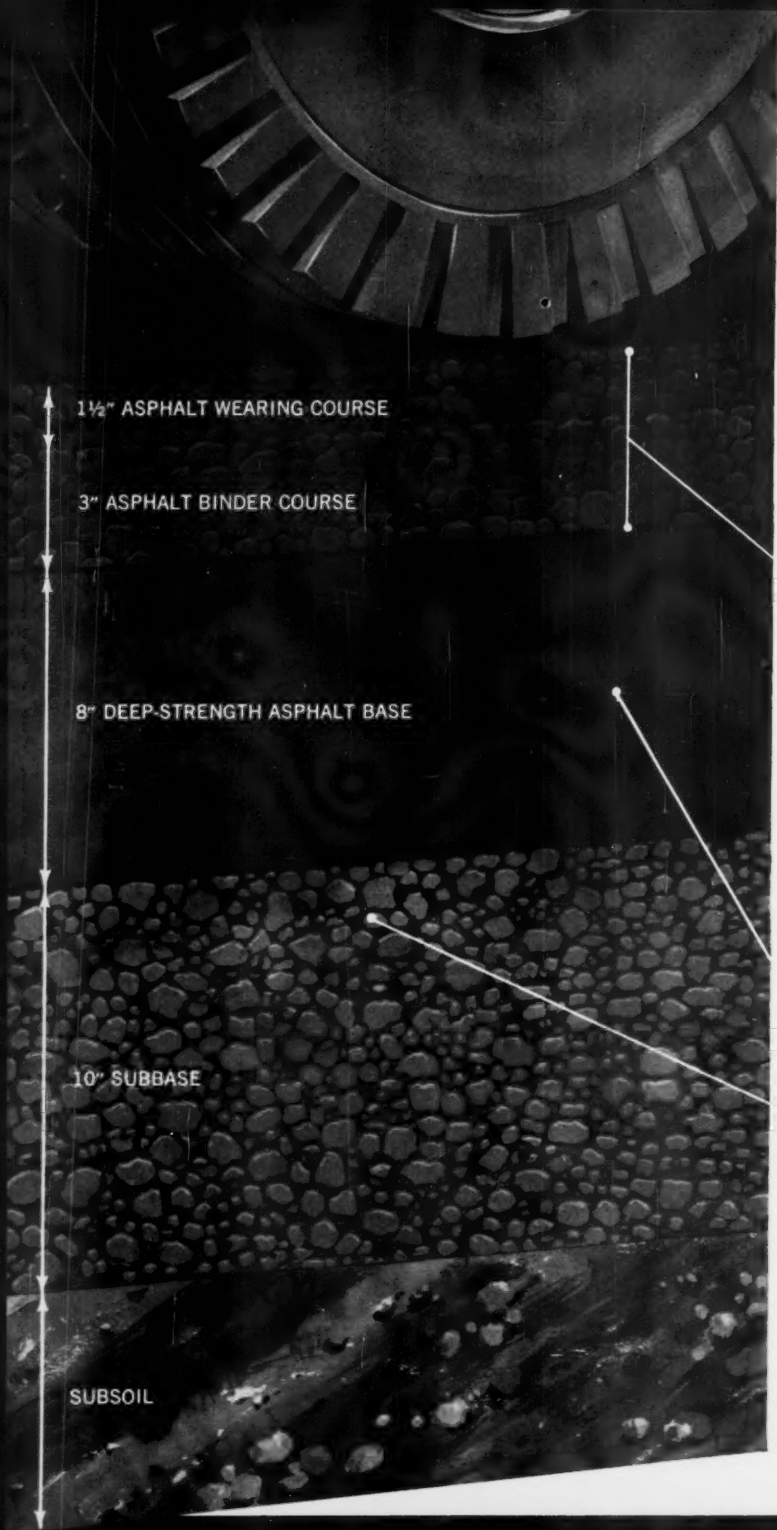

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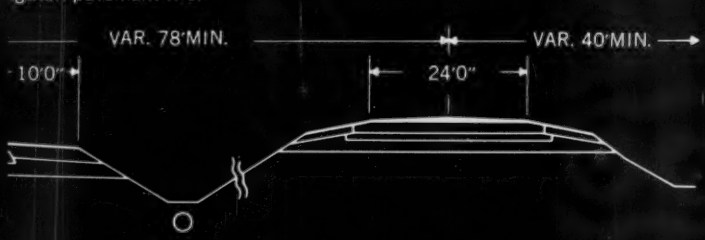

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Letters to the Editor

Interesting Issue . . .

Dear Editor:

With your January issue of AMERICAN ENGINEER, I believe you have hit a new "high" in your engineering journalistic reporting. To my way of thinking there was nothing left to be desired by either the young engineer or the ol' timer; i.e., articles of interest to us all on professional aspects.

One detail however, if you please; is this magazine being sent to all the engineering college libraries around the country? It is a partial waste of good effort, producing this magazine, if it is not made available to our future young engineers.

ROBERT E. SIMON, P.E.
Weymouth, Mass.

► **Editor's Note: The AE is sent to major engineering college libraries throughout the country.**

Not Qualified . . .

Dear Editor:

This is a comment on your recent articles, "Why I Like Working for a Smaller Company," and "Why I Like Working for a Larger Company," by Mr. Ault and Mr. Linville, respectively.

Admiral Rickover points out, correctly, (AMERICAN ENGINEER, Jan., 1960, p. 20), that an engineer may cease to be a professional when he accepts a managerial position. He "becomes a member of an administrative hierarchy."

Mr. Ault and Mr. Linville both carry the titles of managers. Moreover, their articles are sprinkled with platitudes of the type found in books on management. In view of this, I do not believe that these gentlemen are qualified, ethically, to write in this journal on the subjects on which they have written.

LAWRENCE FLEMING, P.E.
Pasadena, Calif.

Salaries and Registration . . .

Dear Editor:

I noted with interest, the item "Registered Engineers Rate Higher in ITE Salary Survey" in the January issue.

It is quite likely that a similar survey in other fields of engineering would yield similar results. This poses the interesting question, "Which is the cause and which the effect?" I doubt that very many engineers are paid more than their associates because of their registration, with the possible exception of those jobs where registration is a prerequisite to taking responsible charge of projects.

Engineers who have taken the trouble to obtain registration when it is not specifically required for their job, and especially those who have joined NSPE and are active supporters of the Society, are those who recognize their responsibilities to the profession. This awareness and willingness to do more than criticize others for not helping them cannot help but be reflected in their work attitude and the quality of their work. This, in turn, shows up in higher salaries and advancement in position.

I hold no brief with engineers who complain of low salaries, lack of professional recognition, etc. The chronic complainers almost invariably say "Why don't they do something about it?" My answer is "Who is this 'They' you speak of? The only guardian angel you and I have is a little fellow named 'Me'."

It is true that many companies will not pay adequate salaries, even to top-grade engineers. In this case, the engineer is free to shop around and find a company which will give fair pay. After all, that company can only pay low wages for top help so long as top help agrees to work for low wages. Therefore, by refusing to accept this arrangement, our friend helps not only himself but everyone who follows him in the position. The same is true of "professional recognition."

To carry my original thesis a bit further, I would like to see a survey of salaries versus participation in church, school and civic activities and in technical societies. Would anyone like to place bets on whether higher salaries are commanded by engineers who unselfishly devote a great deal of time to these activities or by those whose work leaves them no time for outside interests?

IRVINE A. HILL, P.E.
Los Angeles, Calif.

'Wonderful Presentation' . . .

Dear Editor:

Congratulations on the January issue of the AMERICAN ENGINEER. It is a wonderful presentation of the unity proposition and situation, which should go a long ways toward turning "unity" into "harmony."

PAUL B. MOORE, P.E.
York, Pa.

Construction Contracts . . .

Dear Editor:

The letter from Alfred H. Samborn in your January issue, quoting the editorial in *Steel* by Irwin H. Such, is completely in line with the ideas held by the writer for many years in connection with construction contracts.

The costs incurred by bidders on major construction projects are substantial and necessarily are reflected in higher prices for the work. It is simple mathematics:

Ten contractors compete successfully for ten projects at an average construction cost of y dollars, including profit, each having spent x dollars on each project. In each case the cost y must include ten x if the contractors are to make their expected profit. If these are projects in the million dollar range, the examination of the site and all of the local laws, ordinances (and politicians) may well cost each bidder $10,000. With ten bidders, this means an added cost of $100,000 which must be made up on this or other projects. If on other projects, the bidding cost on those must be prorated to the one in point, so here is, say, a ten per cent added expense.

Further, not all of the cost and gamble of preparing bids is necessary.

(Continued on page 55)

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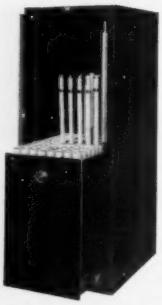

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"This Month"

It is a rare man who, on occasion, does not in a mood of reflection say a silent prayer for a teacher or teachers who in the distant past imbued him with knowledge and spirit and direction. Then how disturbing it is to learn that today we are losing too many of these dedicated and learned men from the ranks of engineering education. Read "The Quality of Our Engineering Teaching" for an eye-opener on what is presently happening. Page 19.

The "merger" of engineering and construction is almost a professional problem and for this reason we are pleased to print "A Cooperative Venture: Engineering and Construction" by one of Stone & Webster's top engineering executives. Page 26.

"An AE Photo Story" begins on page 31. We tell the interesting story of the National Science Foundation, mostly by camera.

And on page 33, the last of three articles on "The Meaning of Your Profession" by Vice Admiral H. G. Rickover. If you haven't read the first two installments carried in our January and February issues, do so now and then finish with Part III.

Other short pieces—easy to read—spotlight surveying in Alaska (page 35); more on nuclear reactor research in Britain (page 39), and an educator's look at the technician problem (page 41).

In the news sections "This Month:"

General. Page 6. EJC, ASHRAE, and AIEE name new officers for 1960-61. In other news, the Census Bureau requests accuracy by engineers, and an Engineers' Week proclamation is signed in New Jersey.

Consulting. An outstanding story wherein a Louisiana architect is found negligent in a court decision, page 8. And on page 10 the headlines read: Consultants Required on Postal Construction, Consulting Group Elects B. H. Tatlow President, Commerce Dept. Asks Raise of Per Diem, and Canadian Engineers Condemn Seal Misuse.

Education. A careful review of the recent Endicott Report on "Trends in the Employment of College and University Graduates in Business" points to the need for more engineering graduates and higher starting salaries. Page 11.

Government. The lead story deals with a new proposal to revise the Federal Classification Act to enable the Government to better compete in the recruitment of engineers and Scientists. Page 12. Other stories are on a new bill in the House to change a Navy Bureau of Ship's engineer-architect requirement, and on Representative Overton Brooks' proposal to bring leading engineers and scientists to Washington every two years for an exchange of ideas.

Industry. Page 15. In a four-day seminar at Harvard University, the AFL-CIO made it clear that they are planning for engineering unions. In another story, technical employees have come in for a new definition by the NLRB.

Registration. Engineers in Worcester County, Massachusetts, have been warned to heed the State's new registration law. In a news story out of Milwaukee comes the happy report that the Milwaukee Common Council has granted pay raises of $25 a month to all city engineers who are college graduates and registered engineers. All on page 17.

Kenneth E. Trombley

Editor

Engineering Groups Elect New Officers for 1960-61

Two major engineering organizations—EJC and ASHRAE—have announced the election of new presidents, while AIEE has listed its nominees for 1960-61.

Augustus B. Kinzel, vice president-research, Union Carbide Corporation, and Cecil Boling, president of Dunham-Bush, Inc., have been elected 1960 president and vice president respectively, of Engineers Joint Council.

Daniel D. Wile became president of the American Society of Heating, Refrigerating and Air-Conditioning Engineers at its semi-annual meeting in Dallas in February. Mr. Wile is vice president and chief engineer of Recold Corporation.

The nomination of Clarence H. Linder, vice president and group executive, Electric Utility Group of the General Electric Company, to be 1960-61 president of the American Institute of Electrical Engineers was announced at the winter meeting of the Institute last month.

Nominated as vice presidents were: Clair E. Gaylord, Buffalo, N.Y.; Robert T. Weil, Jr., New York, N.Y.; Fred W. Bush, Milwaukee, Wis.; Sim C. Wright, Oklahoma City, Okla.; Henry A. Carlberg, Richland, Wash.; Adolph W. Rauth, Jackson, Mich.; Walter Criley, Nashville, Tenn., and Paul G. Wallace, Dallas, Tex.

Nominated as directors were: Robert B. Gear, Chicago, Ill.; Charles T. Hatcher, New York, N. Y., and Cullen T. Pearce, Philadelphia, Pa.

W. R. Clark, Philadelphia, Pa., was nominated as treasurer.

GOVERNOR ROBERT B. MEYNER of New Jersey signs an Engineers' Week proclamation for the 1960 observance in his State. Seated, left, is Edward B. Kirby, West Orange, president of the New Jersey SPE, and Frank G. Manning, right, Jersey City, first vice president. Other New Jersey SPE officers standing are, l.-r.: Warren C. Stadden, Roselle, chairman, public relations; Charles V. Bonhag, Glen Rock, second vice president; Charles J. Dodge, Trenton, executive director, and Vincent S. Wagner, Trenton, secretary-treasurer.

Census Bureau Requests Accuracy by Engineers

In order to obtain accurate statistical data on engineering manpower, the U.S. Bureau of the Census has requested the cooperation of NSPE members in filling out the Decennial Census questionnaire.

The Bureau has asked that each occupational entry give a complete and precise job title—two words in most cases. Some examples could be: chemical engineer—process; electrical engineer—design, and metallurgical engineer—appraisal.

"We are most happy to cooperate with the Census Bureau in this important project," National Society President Harold A. Mosher stated, "and I hope that all professional engineers assist them by providing all necessary information."

The Census will start in April. (See "Thoughts on Professionalism," page 45.)

EW Roundup . . .

A nation-wide roundup of National Engineers' Week programs will be carried in the April AMERICAN ENGINEER. The article will feature photographs and descriptions of local and state projects held during the 1960 Week, which was observed February 21-27.

Engineers Reject Union At Westinghouse Plant

Professional employees of Westinghouse Electric in Athens, Georgia, recently voted 32 to 7 against union representation by the Federation of Westinghouse Independent Salaried Unions. In a separate vote, the salaried clerical and technical employees voted against the same union, 34 to 32.

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Architect Found Negligent In Louisiana Court Decision

- Failed to Obtain Engineering Approval
- Court Increases Damages to $83,000

The potential danger in an architect's failure to submit shop drawings for the installation of equipment in a domestic hot water system to an engineer subcontractor for approval was dramatically described by a Louisiana appellate court recently. As a result of the architect's negligence in this regard, the appellate court increased monetary damages awarded by a lower court against the architect in favor of a widow whose husband was fatally injured in an explosion during the testing of the boiler. The court of appeal raised the damages to $83,000 from $58,000.

A report on the lower court's decision, holding the architect negligent for failing to supervise and inspect the construction of the hot water system, appeared in the February, 1959, issue of the AMERICAN ENGINEER. The architect's appeal of that ruling resulted in the recent decision of the appellate court.

Briefly, the facts in the case were these: A domestic hot water circulating system was installed in a local hospital under a contract between the State of Louisiana and a general contractor. The plans and specifications for this installation were prepared by a firm of registered engineers who were retained by the project architect to prepare all plans and specifications for the electrical and mechanical work involved in the building. The evidence showed that all details of the electrical and mechanical aspects of the project were prepared by the engineer, submitted to and approved by the architect and incorporated into the architect's general plans and specifications for the project.

Prior to the completion of the project, and also prior to the inspection and acceptance of the hot water installation by the architect, the system was fired by employees of a plumbing contractor. Approximately thirty minutes later the boiler exploded, fatally scalding a plumber's helper. The widow of the deceased then sued the architect along with other parties engaged in work on the project. Court testimony brought out that at the time the boiler was lighted no pressure relief valve had been installed on the boiler, although this item was called for in the specifications.

The lower court found the architect to have been negligent in his supervisory responsibilities, but absolved the engineer from liability on the ground that since the architect retained a portion of the fee earned on the mechanical work, the over-all responsibility for the job remained solely with the architect, and no liability could be transferred to the consulting engineer.

Reviewing the case, the appellate court noted that it is customary for a subcontractor who is to install mechanical equipment, to submit to the engineer for approval a "brochure" containing a complete description of all equipment plus shop drawings. This the subcontractor did through the architect, but the engineer disapproved a second brochure after stating that no corrections were made from the first submittal to which he had cited certain exceptions. No further brochures were submitted to the engineer, although a third was approved by the architect.

The appellate court predicated the architect's liability upon two basic acts of negligence:

(1) The failure to adequately and properly supervise installation of the domestic hot water system.

(2) The approval of the plumbing subcontractor's brochure despite two prior disapprovals thereof by the consulting engineer.

It was conceded by all parties that no pressure relief valve or temperature relief control was placed on the boiler of the hot water system as called for in the specifications, and the absence of these valves made the explosion inevitable. However, the court

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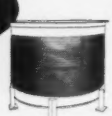

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AE Meetings of Note

American Society of Civil Engineers—National Convention, March 7-11, Jung Hotel, New Orleans, Louisiana.

American Railway Engineering Association—Annual Meeting, March 14-16, Sherman Hotel, Chicago, Illinois.

American Concrete Institute—Annual Convention, March 14-17, Commodore Hotel, New York, New York.

National Association of Corrosion Engineers — Annual Conference, March 14-18, Memorial Auditorium, Dallas, Texas.

American Power Conference—Annual Conference, March 29-31, Sherman Hotel, Chicago, Illinois.

pointed out that "it was the duty of the architect, either personally or through the consulting engineer, to exercise such control and supervision of the system that its construction and completion fulfilled the contract plans and specifications."

The court further declared that the architect's testimony that he was not aware the system was being installed and that he did not inspect the system during installation or after completion amounts to "such gross laxity, indifference and inattention to an assumed obligation" as to constitute negligence on his part. "The terms and conditions of the architect's contract with the Building Authority clearly imposed upon the architect the obligation of supervising installation of all plumbing and heating facilities. Employment of the engineer as required by the terms of the contract between the architect and the Building Authority did not relieve the architect of the burden of supervision since the nature of the engineer's relationship to the architect was, under the circumstances herein shown, essentially that of an agent to whom had been delegated a duty primarily undertaken by the architect as principal."

Concerning the architect's approval of the third brochure after the engineer had disapproved the first two submitted, the court said, "We wish to point out the testimony of the architect clearly shows approval of brochures is the duty of the engineer because the architect is not as well informed as the engineer regarding such technical installations. Despite an admitted lack of knowledge regarding such matters, the record establishes it was the architect and not the engineer who approved the brochure pursuant to which Vince [the plumbing subcontractor] made the installation. The negligence of the architect in the respects shown was a proximate cause of the accident rendering the architect liable in damages to plaintiff."

With respect to the engineer, the court found that the plaintiff could not establish any actionable negligence in her claim that the engineer failed to indicate desired piping details on the blueprint plans and had failed to provide adequate supervision. "Regarding the former, we find that failure to set forth a proposed method of connecting the component parts of the domestic hot water system was not a proximate cause of the accident since all witnesses conceded the cause of the explosion was Vince's failure to install a pressure relief valve on the system. With respect to supervision, the engineer is exonerated from negligence because the terms of his contract obligated him to inspect the system only when advised of its final completion or otherwise requested by the architect. The record clearly establishes the engineer was never advised of the completion of the system and had not been requested by the architect to make any inspection whatsoever."

In answer to a contention raised by the architect, the court pointed out that customary practices in the engineering and architectural professions could not serve to eliminate liability. The architect had maintained that failure to supervise the installation of such a device was not negligence since it is customary in the professions to make only periodic inspections and according to the usual and ordinary practice of architecture and engineering, no inspection was called for until the system was complete and the subcontractor requested final inspection. "The answer to this argument on behalf of the architect is simple and fundamental," the court said. "Custom cannot prevail in the face of positive law and conduct constituting the proximate cause of injury of one toward whom a duty of care is owed which renders the wrongdoer liable in damages to the injured party, irrespective of whether such conduct is in accord with accepted standards and procedure in any given profession or professions."

Although the manufacturers of the equipment involved were joined as defendants, the court ruled that the evidence failed to

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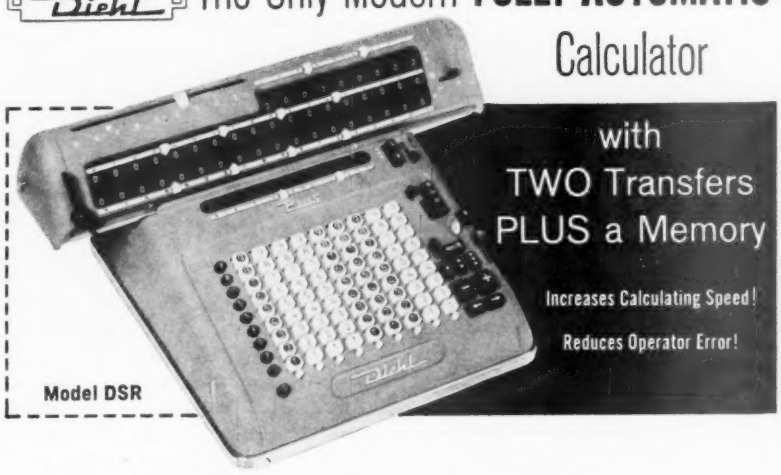

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show negligence on their part. As for the plumbing subcontractor, the court found the record to be "replete with evidence of gross, inexcusable negligence, but this can be of little comfort to the defendant architect. * * * It is basic law that one whose negligence combines with that of another to cause injury cannot plead the negligence of such other as a defense to an action by the injured party."

A concurring opinion by Judge Tate placed great emphasis upon the architect's failure to submit to the engineer the third set of shop drawings prepared by the plumbing subcontractor after two earlier submissions had been disapproved by the engineer for various inadequacies. Judge Tate pointed out that the architect admitted that inspection and approval of shop drawings for water-heating installations fall within the competency of the engineer and not the architect, and that he, the architect, was totally incompetent to determine whether a water-heating system was safe or adequate.

"It was thus the function of the engineer to check the plumbing and heating brochures, and to require that the equipment therein specified comply with the specifications and with the needs of sound engineering; by both of which standards, as the engineer alone was competent to determine, a pressure-relief valve was required. In blindly approving Vince's brochure without submitting it to the engineer, the architect was greatly negligent in his duty of inspection."

Judge Tate further added that "the requirement that trained engineers check the shop drawings of equipment to be used, to assure its compliance with the specifications, was designed to avoid such mistakes as Vince's fatal reliance upon the temperature-relief valve to perform the function of a pressure-relief valve. If, as required by the contract as well as by reasonable prudence, the architects had submitted Vince's shop drawings to the engineer, the absence of a pressure-relief valve for the hot water system should have been discovered and the present accident avoided. I therefore think that the grossly negligent failure of the architects to require engineering approval of Vince's shop drawings was a direct, proximate cause of Vince's failure to install a pressure-relief valve and of the consequent fatal explosion." *(Day* v. *National-U.S. Radiator Corp.,* Court of Appeal, First Circuit, Louisiana.)

Consultants Required On Postal Construction

A recent Post Office Department publication on construction requirements for leased postal facilities prescribes the use of consulting engineers and architects. Where local, county, or state laws, regulations or ordinances require the services of a registered engineer or architect to prepare plans and specifications the regulation states, the bidder must comply.

In any event, the Post Office adds, the bidder "is encouraged to procure the services of a competent architect or engineer in all instances." Regional offices of the Department will have final authority in applying the requirement.

The complete bidders' instructions, (POD Publication 39, Sept. 1, 1959), may be obtained from the Government Printing Office.

Consulting Group Elects B. H. Tatlow President

Richard H. Tatlow III, president of Abbott, Markt & Company, New York, N.Y., has been elected president of the American Institute of Consulting Engineers, it has been announced.

Others elected as members of the Governing Council are: John G. Frost, partner, Wiggs, Walford, Frost & Lindsay, Montreal, Canada; Ray E. Lawrence, partner, Black & Veatch, Kansas City, Mo., and Gilbert I. Ross, partner, Ross & Company, New York, N.Y.

Announcement was also made of two new vice presidents of the Institute—Gerald T. McCarthy, partner, Tippets - Abbett - McCarthy-Stratton, New York, N.Y., and Harold M. Lewis, also of New York City.

Commerce Dept. Asks Raise of Per Diem

The Secretary of Commerce has requested authority to increase from $50 to $100 the per diem rate which can be paid experts and consultants performing intermittent services for the Department. The present $50 rate is set by annual appropriation measures, but the Secretary has proposed a statutory authorization of $100.

To justify his request, the Secretary told Congress that while the $50 per diem limitation was sufficient in years past, "increasing difficulty has been experienced in obtaining the services of individuals who are truly qualified as experts because of the fact that such individuals in private employment now receive compensation at rates substantially in excess of the $50 per diem ($13,000 per annum) rate available for serving the Government. In numerous instances the experts whose services are desired receive twice as much as the maximum Government rate, or more. As a result, the Department is handicapped severely in procuring the services of experts and consultants."

Canadian Engineers Condemn Seal Misuse

One of the most common violations of the Canadian Engineer's Code of Ethics, according to the *British Columbia Professional Engineer,* is the improper use of the professional engineer's seal.

The specific violation referred to occurs most often when an engineer is asked to check a certain element in a set of plans, such as structural design, and applies the seal to the plans upon finding this element satisfactory. This is, however, a violation of the Code of Ethics.

The applicable section of the Canadian Code states the seal is to be used only on those specifications and plans actually prepared by or under the direct supervision of the engineer himself. The Code makes it clear that the seal of a professional engineer indicates his responsibility for the entire set of plans rather than a certain segment.

Endicott Report Indicates More Grads, Higher Salaries

Sizeable increases both in number of engineering graduates needed and in starting salaries paid are indicated by the fourteenth annual Endicott Report on "Trends in the Employment of College and University Graduates in Business and Industry," prepared by Frank S. Endicott, director of placement, Northwestern University.

Companies surveyed indicate they will need 19 per cent more graduates, both engineers and nonengineers, than they did in 1959. The 202 medium-to-large companies questioned say they will need 7,396 engineers and 9,863 nonengineers for a total of 17,259. The 1959 total was 14,511, of which 6,212 were engineers.

Starting salaries are again expected to increase, with the engineering graduate getting about $80 more per month than his nontechnical colleague. The engineer can expect to start at about $515, as against $489 in 1959, while general business trainees will only get about $424, an increase of $13 over the previous year. In last year's report, however, Endicott pointed out that engineering graduates lose their salary advantage within five to ten years of graduation.

In anticipation of the greater competition for the 1960 graduates, almost half of the polled companies said they would include more campuses this year in their recruiting drives. Of 205 companies reporting, ninty-eight intend to visit more colleges, sixty-eight plan to contact the same number, and only thirty-nine will go to fewer.

On the other hand, many firms said they have had trouble lately in persuading graduates to leave their native regions for distant jobs. In a recent "career carnival" at Michigan State University, many industrial recruiters said they would concentrate more intensively on colleges located near their businesses, and would actually contact fewer colleges than previously. They noted that colleges drawing most of their student body from nearby areas turned out fewer graduates willing to travel than did the more "cosmopolitan" universities. In line with the "intensive" approach, some companies said they would start their recruiting programs earlier this year than in the past. Some said they would try for student commitments by March or April instead of waiting until June.

The Endicott Report also covers the problem of turnover among newly employed graduates. The reasons given for leaving show that the dissatisfied graduates felt they were in the wrong business, were not challenged by thir jobs, wanted more pay, or preferred to live elsewhere. To remedy this, the report suggests more careful screening of applicants, more challenging and interesting assignments, and more personal recognition.

When listing the shortcomings of newly employed graduates, the complaints of employers dovetailed closely with those of the graduates. The employers said the new men expect too much too soon, do not like routine training assignments, lack specific personal goals, and do not understand the business world.

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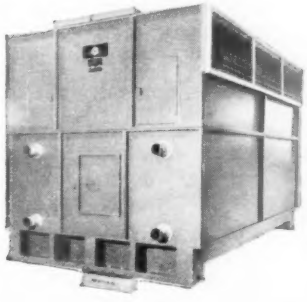

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Proposal Is Made to Revise Federal Classification Act

A five-point proposal for revising the Federal Classification Act to improve the Government's competitive position in the recruitment and retention of adequate numbers of qualified engineers and scientists has been made by NSPE to the House Committee on Post Office and Civil Service. Committee Chairman Tom Murray has described the Society's recommendations as "a very thoughtful and constructive approach to one of the serious problems encountered in our current study of the Federal classified pay system and related salary laws."

The guiding principles recommended to the Committee in a letter from NSPE Executive Director Paul H. Robbins were:

1. The establishment of procedures vesting authority in agency heads, if practical, to set starting rates of pay for engineers and scientists at a level which competitively compares with the then-prevailing starting rates in industry and other fields.

2. Recognition of the exceptionally high demand for certain categories of engineers and scientists, particularly in new and highly-specialized fields, and the establishment of salary levels which acknowledge the critical need for their talent and which compare competitively with salaries they could expect in nongovernmental employment.

3. The establishment of procedures for quickly, efficiently and effectively adjusting salaries for engineers and scientists as nongovernmental rates for comparable employees change.

4. Development of a program for rewarding outstanding ability, merit, job performance and responsibility through adequate salary adjustments.

5. Elimination of the artificial distinction between the "super-grades"—GS-16, 17 and 18—and the other fifteen grades of the General Schedule, and the removal of statutory limitations on the number of such positions.

The National Society indicated its support for a salary system attuned to changing market conditions so that Federal salaries could be adjusted promptly and effectively. It further declared that the adoption of a meaningful and effective "flexible" salary system for Federal classified employees will "materially and significantly aid in solving the Government's recurring problems with respect to engineering and scientific personnel," and "is absolutely essential if the Government is to achieve a permanent, lasting solution."

The Society called for the speedy introduction and passage of legislation along the lines of its proposal.

"I lost my breakfast on the take-off, but after that it wasn't so bad."

Bill Passed on Engineer-Architect Requirement

The House of Representatives has passed a bill which would remove the present statutory requirement that the deputy chief of the Navy's Bureau of Ships be specially qualified and experienced in naval engineering if the chief of the Bureau is specially qualified and experienced in naval architecture, and vice versa. The present law was adopted in 1940 when the Bureau was established so that both naval engineers and naval architects under its jurisdiction would have equal opportunity for appointment to the two top positions in the Bureau.

The Navy asked Congress to eliminate the requirement that the chief and deputy chief be of opposite qualifications because the technically trained officers now under the jurisdiction of the Bureau are basically a homogeneous group, and "it is difficult to distinguish an architect from an engineer except for the most expert design specialists." The Navy further characterized the present requirement as an unnecessary restriction in the selection of these officers and "an obstacle to the best utilization of Engineering Duty Officers."

The bill would require only that the chief and deputy chief of the Bureau be detailed from officers who are specially qualified and experienced in naval engineering or naval architecture. (H.R. 9464 and H. Rept. No. 1208)

House Committee Sets Up Special Forum

The House Committee on Science and Astronautics has recently announced a plan to bring a dozen outstanding engineers and scientists to Washington once or twice a year where they could exchange theories and ideas. In announcing this "forum" program, Committee Chairman Overton

(Continued on page 14)

Federal? State? County?

Municipal? Armed Services?

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Members of NSPE, as PARTICIPANTS in the Functional Section for Engineers in Government Practice, can become directly associated with programs and activities designed to further the interests of Governmentally-employed engineers within the framework of the National Society.

Current Functional Section programs include:

- **A comprehensive study of state and municipal merit system provisions and personnel policies for engineering employees.**
- **Preparation of a pamphlet explaining the needs, advantages and requirements for registration by engineers in Government service and the Armed Forces.**
- **Contact with personnel officials of Federal agencies in order to develop continuing liaison and exchange of ideas relative to improvement of engineering personnel policies.**
- **Study and analysis of legislative proposals relating to the classification and compensation of Federally-employed engineers.**
- **A Task Force study of means to implement the special pay provisions under the Armed Services Pay Act of 1958 for engineer officers.**

In addition, other Section activities are concerned with attempts to unionize engineers employed by city governments, a constant scrutiny and evaluation of Federal personnel policies as they relate to engineering personnel, and efforts to stimulate agency policies encouraging registration.

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As a participant in the Functional Section you will be placed on the mailing list to receive periodic reports, newsletters and other information on current developments pertinent to the interests of engineers in government practice and the armed forces.

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(Circle 5 in Readers' Service Dept.)

GOVERNMENT

(Continued from page 12)

Brooks of Louisiana declared, "We shall provide for these men of science a forum in which they can speak out to the world on the problems that face it in basic and applied science, in space technology and space exploration.

"It is unfortunately true that too many times scientists with important ideas that would help advance the interests of the United States and mankind in general have been unable to find anyone to listen to them. Theirs have been, on too many occasions, voices in the wilderness."

Controversy Over College Housing Loan Program

Sharp differences of opinion have been voiced within recent weeks over the merits of the present college housing loan program, with some Senators urging an expansion in funds and the President recommending in his Budget message that the program be terminated.

Instead of the present program, the President recommended enactment of a bill he sent to Congress last year, known as the "College Facilities Act of 1959" which would permit the Commissioner of Education to guarantee $1 billion in bonds issued by private colleges and universities to obtain money with which to construct housing, academic buildings or related facilities. In addition, the Eisenhower program would authorize Federal grants to pay twenty-five per cent of the principal on $2 billion in bonds issued by both private and publicly supported educational institutions. "This program," the President said, "would provide aid on a much broader basis, and result in the construction of much larger total amounts of college facilities per dollar of Federal expenditures, than the present more limited college housing loan program which should be allowed to expire."

However, two weeks after the Budget message, Senators J. W. Fulbright of Arkansas and John J. Sparkman of Alabama jointly introduced a bill to increase by $500 million the authority of the Housing and Home Finance Agency to make college housing loans. According to Senator Fulbright, the present revolving fund of $1.175 billion is exhausted, and the HHFA has now pending loan applications from 126 colleges aggregating about $150 million. (S. 2950)

Although in favor of the President's bill, Senator Jacob Javits of New York has introduced an emergency, stop-gap measure which would provide an additional $250 million for college housing loans. In a statement made on the Senate floor, Senator Javits said a college housing loan program "cannot be scrapped in this critical era when American youth must equip itself to meet the demands of U.S. world leadership and the challenge of the space age. Only new loan funds made available promptly can help keep college doors wide and properly open in the years ahead." (S. 2911)

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(Circle 6 in Readers' Service Dept.)

Bill Introduced to Amend Federal Highway Act

Representative Morgan M. Moulder of Missouri has introduced a bill to amend the Federal Highway Act by requiring surveys, plans, specifications, and estimates for each proposed project to include provisions for alternate construction by Portland Cement concrete and asphaltic concrete of comparable design.

According to the proposal, all plans and specifications for proposed projects on the Federal Highway System submitted for approval would have to provide for alternate construction, and contracts for such construction would be awarded upon the acceptance of alternate bids in accordance with the lowest bid price. (H.R. 9586)

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AFL-CIO Four-Day Seminar Plans Engineering Unions

A growing concern by industrial unions over the decreasing percentage of production and maintenance workers in industry as compared with the growing and largely nonunion percentage of engineers prompted a recent four-day seminar at Harvard University entitled, "Collective Bargaining Problems of Professional and Technical Workers." Sponsored by the Industrial Union Department, AFL-CIO, the meeting was attended by representatives of eight AFL-CIO and two independent unions, with speakers including sociologists, educators, union staff members, and one management spokesman.

An example of the problem was given of a chemical company which had decreased its production workforce by four per cent from 1946 to 1956, while increasing its professional and scientific employees by 40 per cent, its staff of technicians by 45 per cent, and its managerial and administrative personnel by 35 per cent.

Many union representatives present felt this trend was accentuated by the present NLRB policy of excluding technical employees from voting units upon request of either party. It was said this encouraged employers to "carve out" technical groups prior to NLRB elections, thereby robbing unions of workers properly belonging in production and maintenance units.

The AFL-CIO official summary said there was general agreement that organized labor will have to change its traditional approaches if it is to succeed in organizing professionals. While in the past, unions have stressed strict seniority, group solidarity, and emotional appeals, it was felt that engineers would favor programs allowing for professional recognition, individual advancement, and the opportunity to conduct scientific research free of nonprofessional interference.

The unions felt that their strongest bargaining point was the "inevitability" of tensions between professionals and the "profit-making bureaucracy" employing them. It was stated that these tensions could only be removed by unionism.

Another factor in engineers' resistance to unions was said to be the present tight labor market for professionals. The seminar concluded that the loosening of this market will cause salaries and working conditions to deteriorate and force engineers to organize in self-protection.

Technical Employees 'Defined' by NLRB

In three recent decisions the NLRB has shed light on the question of how they will apply the criteria for definition of technical employees as outlined in the *Litton Industries of Maryland* case of December 16, 1959.

In the *Litton* case, the Board said it would not apply the term technical employee "mechanistically," but would limit it to those who ". . . do work which is affirmatively shown by the record to be of a technical nature involving the use of independent judgment and requiring the exercise of specialized training usually acquired in colleges or technical schools or through special courses."

• In the first of three cases, involving the Minneapolis-Honeywell Co. and the International Union of Electrical, Radio and Machine Workers, AFL-CIO, the Board held that in four of the

PGEEA Affiliates With MSPE

The petition for affiliation of the Pittsfield General Electric Engineers Association with the Berkshire Chapter of the Massachusetts SPE is accepted by MSPE President Walter J. Kreske (second from right). The petition was unanimously approved by the MSPE board of directors at its January meeting in Framingham. PGEEA will now affiliate with MSPE as a functional group in industry. Presenting the petition to Mr. Kreske is PGEEA President William A. Wooldridge. Left to right are: James W. Simpson, PGEEA vice president; Mr. Wooldridge; John P. Ellis, president, Berkshire Chapter; Mr. Kreske, and William J. Degnan, MSPE chairman of functional groups and a member of the MSPE board of directors.

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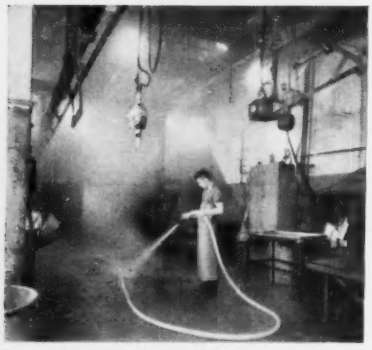

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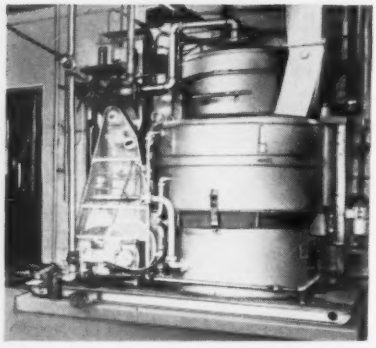

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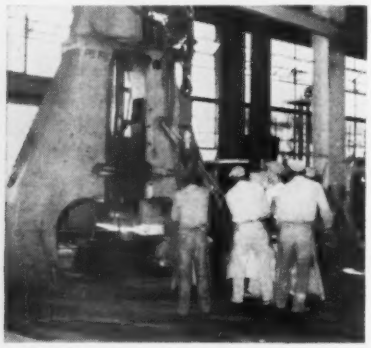

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(Circle 7 in Readers' Service Dept.)

seven job classifications in dispute the workers involved met the standards for technical employees and would not be included with the production employees in the voting unit. These employees included instrument builders, design technicians, engineering testers, and design draftsmen. In all four of the classifications held to be technical, the employees were required to use independent judgment in their work, and in three of the four, two years of technical school study were required. In the fourth category, involving draftsmen, only one year of technical training was required, but in the view of the Board their use of independent judgment and close cooperation with design engineers entitled them to be considered technical employees.

In all three of the classifications found to be nontechnical, including those in the mechanical lab, materials lab, and stock cribs, the deciding factors were the lack of requirements for independent judgment and technical school training, even when employees worked closely with engineers.

• In the case of Dit-Mco, Inc., of Kansas City, and the International Association of Machinists, the Board found that six test-out technicians should be excluded from the production and maintenance voting unit. Here again, the basis for the decision were technical school education and use of independent judgment.

• The last of the three decisions held that seven model makers at Westinghouse Electric Corporation's Meter Division (Newark, N.J.) did not quailfy as technical employees and should not be represented by the Federation of Westinghouse Independent Salaried Unions. The model makers, currently members of the International Union of Electrical Workers, were held comparable to instrument makers and tool and die makers in the production unit in that they were not required to have technical academic training, and exercised independent judgment only in designing the tools used for construction of the models. The Board held the FWISU is not the "traditional representative" of such employees.

Engineers Urged to Pay Heed To Registration Law in Mass.

William T. Buckley, district attorney of Worcester County, has become the first major law enforcement official in the State of Massachusetts to issue a public warning to all nonregistered engineers and would-be engineers to pay heed to the mandatory requirements of the Engineers Registration Law passed by the Massachusetts Legislature a little over a year ago.

His statement, which was later given to the press, came in a letter to Richard H. Merritt, president of the Central Massachusetts Chapter of the MSPE praising the Chapter and the State organization for its work in "apprising engineers, those connected with engineering and the public at large," of the Professional Engineers Registration Law.

"The law," Mr. Buckley's statement read, "specifically requires registration as a Professional Engineer of any person who practices engineering or represents himself to be a professional engineer in any way, whether by verbal claim, sign, advertisement, letterhead, cards or otherwise, or implies through the use of some other title that he is a Professional Engineer.

"Any person not duly registered as a Professional Engineer who accepts an appointment as City Engineer or Town Engineer for any city or town is in violation of the law. Any person not duly registered as a Professional Engineer who holds himself out as able to perform, or who does perform any engineering service or work or any other professional service designated by the practitioner or recognized by educational authorities as engineering is in violation of the law and is subject to prosecution by the Attorney General or District Attorney."

Use AE's Readers' Service Department— See Page 58!

Refresher Course Given At Griffiss A.F. Base

To encourage engineers to become licensed and registered in New York State, Janis A. Liepins is conducting an informal college refresher course for engineers, both military and civilian, employed at Griffiss Air Force Base, Rome, N. Y.

This course is strictly on a voluntary basis and is conducted twice weekly immediately after duty hours at no cost to the government or to the students.

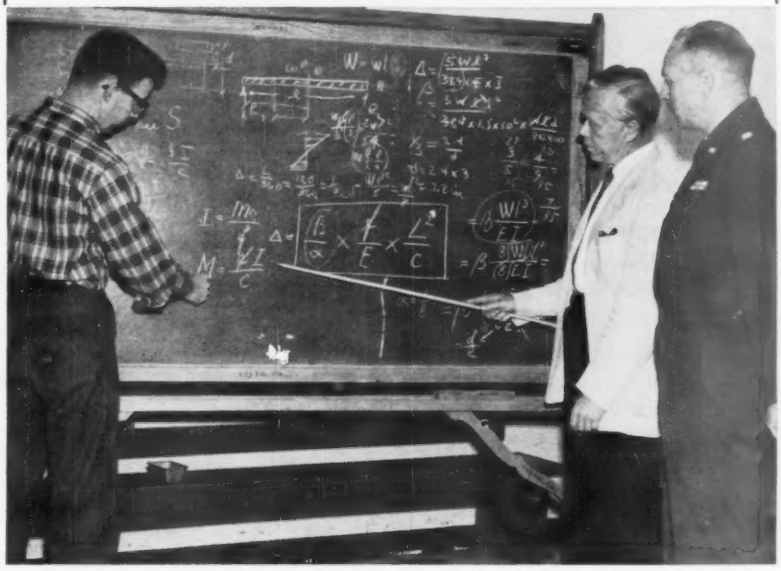
Milwaukee Gives Raises To Registered Engineers

In a recent move boosting registration, the Milwaukee Common Council voted to give an extra $25 per month to city engineers who are college graduates and registered as engineers.

According to the *Milwaukee Engineer*, the increase was in addition to a four per cent across the board raise for city employees, and was opposed by Robert C. Garnier, city personnel director, who said the engineers deserved the extra salary no more than hundreds of other city employees in the higher brackets.

In voting the bonus, the Council Finance Committee reversed its previous stand which held that the engineers should not receive the $25 unless other higher range employees were also rewarded.

Engineering Refresher Course



An engineering problem is worked out on the blackboard by Pat Kotary, left, under the supervision of Janis A. Liepins, center, who is conducting an engineering refresher course at Griffiss Air Force Base. Mr. Liepins organized the course in October and conducts the course strictly on a voluntary basis. Looking on is Lt. Col. Byron R. Fowell, GAFB civil engineer. Mr. Liepins is employed at Griffiss AFB as a general engineer, civil-architectural. (See story above.)

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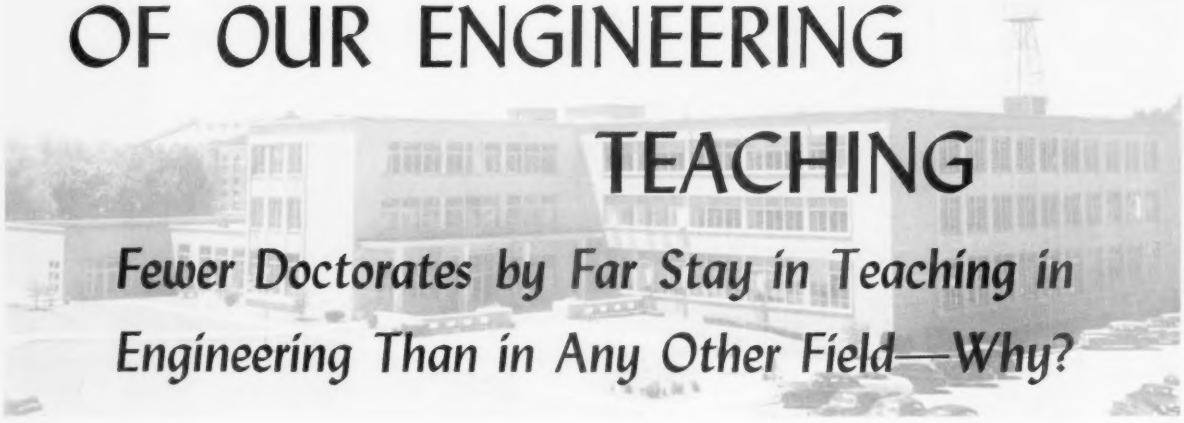


Fewer Doctorates by Far Stay in Teaching in Engineering Than in Any Other Field—Why?

ENGINEERING curricula and education in general have undergone an almost microscopic study in the post-Sputnik era. Quantity, quality, methods, and the like have been the subjects of an almost endless stream of surveys and analyses.

But, what of the engineering faculties? The engineering schools of the nation can hardly be expected to keep up with the burgeoning demands of technological change if they are not provided with teachers of sufficient quantity and quality.

Are these schools getting their necessary share of the country's top engineering brains? Engineers and educators will not agree on all facets of the question, but few doubt that the quality of engineering instruction holds the key to providing the nation with a continuous supply of top-grade engineers.

Certainly, the nation's universities and colleges face tremendous competition in retaining their faculties and in attracting new high-caliber personnel to the teaching profession. Industry offers attractive lures—particularly in the area of salaries—which many would-be teachers find hard to ignore. Outside of the realm of monetary gain, industry has other big advantages, some of them realistic, others unrealistic depending on the individual's viewpoint. Some look upon industrial careers as an opportunity to make immediate and tangible contributions in engineering. There are others who feel, rightly or wrongly, that the engineer in industry has a certain prestige factor that is lacking in an academic career.

The technological explosion of recent years hasn't made the problem any easier. Engineers with graduate degrees in specialized fields of knowledge—a group many believe is badly needed in the colleges—are in higher demand than ever by industry.

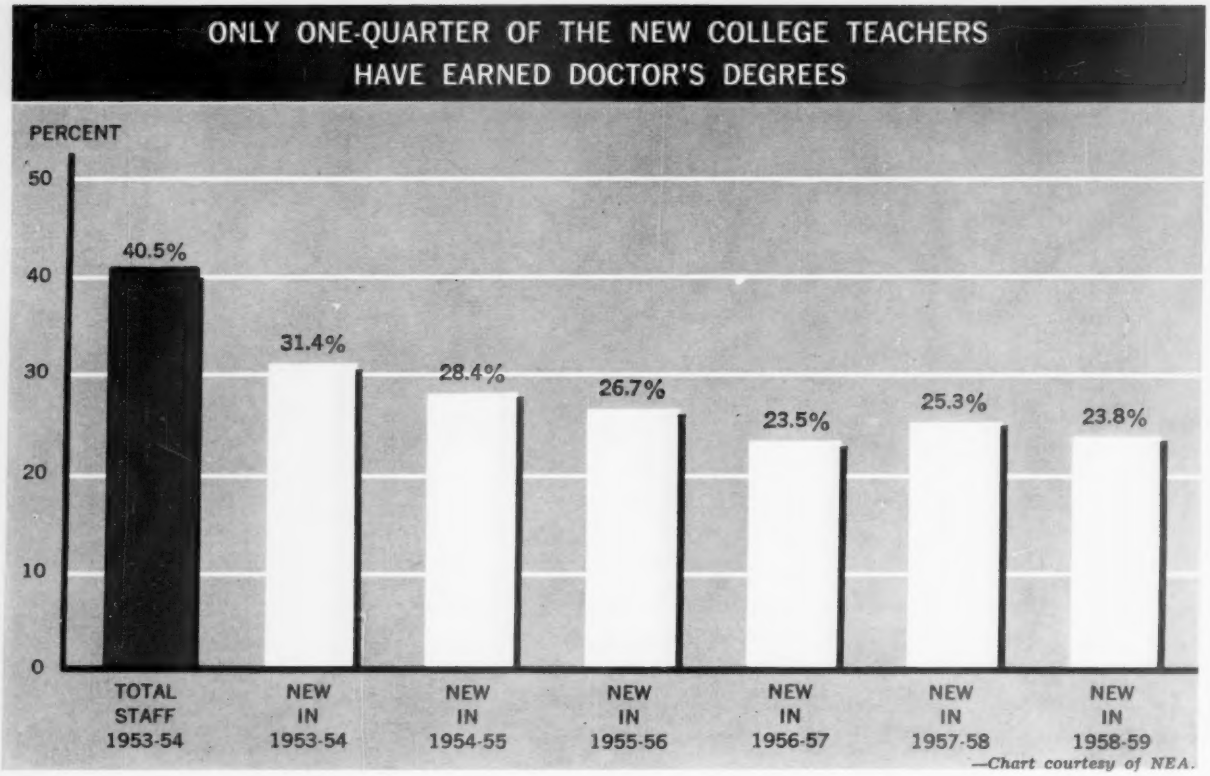
In a recent report, the National Education Association cited the failure of engineering doctorates to enter the college teaching field as a "cause of special concern." Only about a third of the students receiving doctorate degrees in engineering from 1956 to 1958 went into college teaching, the NEA report said. This, the report noted, is considerably lower than a 44.5 per cent average for all fields.

The NEA survey also revealed that during a five-year period from 1953-1954 to 1958-1959 only about one in seven new teachers in engineering held the highest degree, while more than forty per cent entered college teaching without the benefit of advanced study to the level of a master's degree.

The NEA report puts emphasis on academic achievements in the analysis of the teacher supply. This, in the minds of some engineers, is a shortcoming of the survey in that it fails to take into account practical industrial experience of some of the engineering professors. Others will argue that many engineering subjects, especially those at the freshman and sophomore levels, don't necessarily require a doctorate.

"I think it is a shame to discourage a good teacher from joining an engineering faculty simply because he hasn't a doctorate," one engineer told the AMERICAN ENGINEER. "What we need, particularly at the freshman and sophomore levels, are teachers who will stimulate their students; doctor's degrees per se don't make good teachers."

This school of thought can gain a certain amount of support from



—Chart courtesy of NEA.

the fact that the total number of engineering doctorates is still relatively low in this country. Prior to World War II there was little demand for graduate study in engineering and consequently few candidates for the doctorates; it has only been in recent years that necessity for graduate study has become evident.

EVEN those who tend to downgrade the value of the doctorate as a criteria for faculty evaluation concede that a certain number of these graduate degrees are necessary for balanced staffs. This apparently is becoming more and more true as complexities of engineering sciences grow.

And the NEA report raises a serious question as to whether the engineering schools are getting a sufficient number of these new doctorates.

Many engineering educators appear to agree with the NEA's theory that the doctorate is a very important necessity on an engineering staff. Gordon S. Brown, dean of the School of Engineering at Massachusetts Institute of Technology, says that it is a consensus of his colleagues at MIT that a doctor's degree in engineering or applied science is a "requisite for first-rate competence as a teacher of modern engineering."

At New York University's College of Engineering, Dean John R. Ragazzini told the AMERICAN ENGINEER that he did not anticipate employing any engineering professors who do not have doctoral degrees. The only exceptions, Dean Ragazzini said, would be junior staff members who are actually working toward their doctoral degrees at NYU or neighboring institutions. Any position from assistant professor and upwards at NYU carries the doctorate requirement.

Georgia Institute of Technology reports that about forty per cent of its new personnel added to its engineering staff in the past three years has doctorates. Most of the remainder are pursuing graduate work at this time.

"I think it would be highly desirable to have a much larger proportion of our engineering teachers with doctor's degrees provided this could be done without sacrificing other desirable qualities," J. W. Mason, dean of Georgia Tech, said.

Dean Mason said he believed that the great bulk of engineering teachers should have had a reasonable contact with industry at some stage in their development and should keep continuously in touch with the practice of the profession.

"In addition these men should be people with an ability to teach and a desire to teach . . . unfortunately, not all Ph.D.'s have these qualities," Dean Mason commented. "It is my personal opinion in engineering and science we have have tended to overemphasize the importance of doctor's degrees and research ability and ignore the very desirable attribute of good teaching ability."

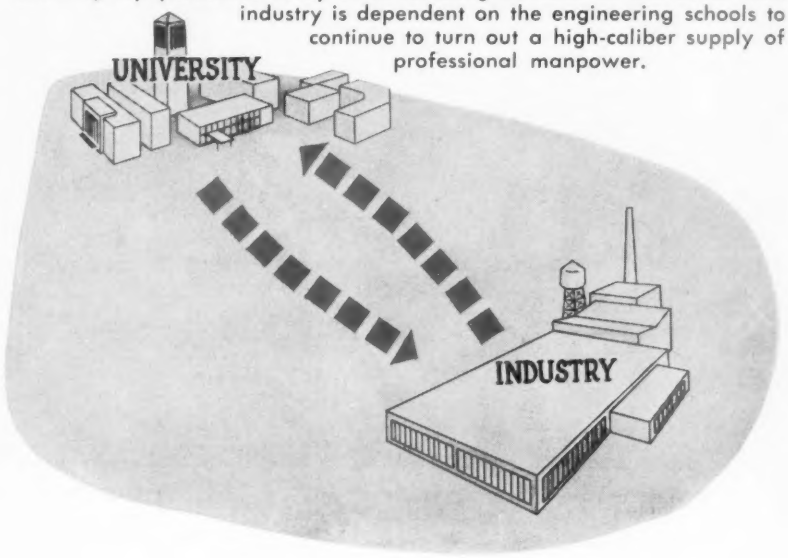
At nearby Auburn University, Dean Fred H. Pumphrey with somewhat similar conclusions. ". . . It is my belief that a staff should be well balanced between men with academic qualifications and men with professional experience," he commented.

California Institute of Technology at Pasadena is one of the nation's pioneers in providing graduate study for engineers. The comments of the chairman of its

Division of Engineering, F. C. Lindvall, are particularly significant:

"Without question enrollment for graduate study in engineering will continue to increase despite the present decrease in undergraduate enrollment because of rising professional standards and the needs for greater skills and sophistication of modern engineering practice. Faculties for graduate instruction in the future will include more and more people who themselves have had graduate work and the research experience which are a necessary part of good graduate education. Also the number of students per teacher is smaller in graduate work which creates a demand for teachers at the graduate level which increases more rapidly than the number of students enrolled. It seems quite clear that the best way to get good people into engineering teaching is through graduate education in engineering with or without industrial experience as seems appropriate."

Many educators fear that industry, with its relatively high salaries, is drawing top personnel away from teaching careers. At the same time industry is dependent on the engineering schools to continue to turn out a high-caliber supply of professional manpower.



SOME of the deans contacted by the AMERICAN ENGINEER expressed outright concern over the present level of quality on a nation-wide basis.

"I would say that in the entire national picture the present quality of engineering teachers is not adequate," California Tech's Lindvall commented. "Much upgrading is necessary and many new teachers are needed to provide the education which the students graduating five to ten years hence will need in order to cope with rising levels of technical effort."

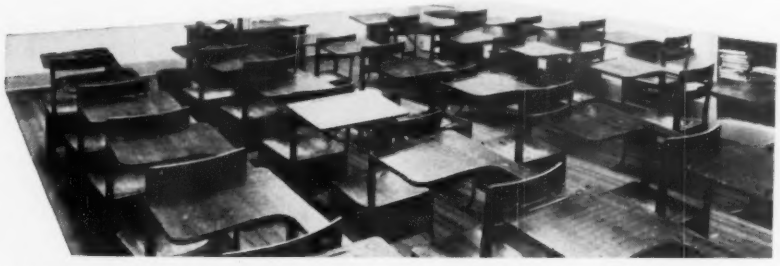
At NYU, Dean Ragazzini viewed the problem this way:

"The quality of present engineering professors is not entirely satisfactory since there are many who are on our faculties who came up from an era when the scientific and mathematical requirements were not too severe. New staff members generally are of satisfactory quality."

Dean Brown of the MIT School of Engineering says his school is conscientiously attempting to develop young people with the doctor's degree and encourage them to enter engineering teaching. He said a recent check of the records for the past decade indicated that between forty and fifty per cent of the doctoral graduates of some departments had entered teaching as a career.

George Washington University at Washington, D. C., is an example of schools which have seen a rapid increase in the number of doctorates on their engineering staffs in recent years. George Washington's engineering dean, M. A. Mason, says that his engineering staff had only one doctorate eight years ago, but now nearly one-half of the staff holds the degree. Dr. Mason believes the quality of engineering faculties generally is going up around the nation.

The problem of obtaining and retaining top-grade faculties is obviously a many-faceted one. Salaries, undoubtedly, are at the core of the situation. But, there are other considerations like the availability of good research facilities, academic climate and academic freedom that apparently weigh heavily. General social attitudes, too, are important. Many feel once the public decides to hold education and educators in higher esteem that much of the problem of attracting top men will be alleviated. Low salaries, this group contends,



Will engineering classrooms of tomorrow be empty for lack of enough engineering teachers? Many educators believe more of engineering's top talent must be encouraged to take up teaching as a career to ensure a continuing supply of well-trained engineers.

Many deans of engineering feel their staffs should be balanced between professors with straight academic backgrounds and those with some industrial experience. Salary differentials often make it difficult for engineering schools to compete with industry for this personnel.

are plain indications of the public's attitude toward education.

At the request of the AMERICAN ENGINEER, Auburn's Dean Pumphrey outlined the problem of teacher-recruitment:

"During my recruiting experience, I became convinced that many of the Ph.D.'s who are now going into industry would prefer to remain in teaching if adequate salaries were available. As a matter-of-fact, most of them are willing to accept a somewhat lower salary in teaching than in industry; but we have been, in most cases, asking our teachers to accept a salary differential which was unjust.

"It is certainly true that salary is not the only handicap in obtaining a well-qualified teaching staff. They must be given assurance of an opportunity for professional development and a real challenge if they are to be attracted. This will usually require research programs which will continue to develop their capabilities and their opportunities for publication in the professional press. They must also be treated on the campus as professional men of high standing. When these items of well-being are taken care of on the college campus, there should be little difficulty in recruiting good teachers."

NYU's Dean Ragazzini believes that if we are to increase the actual available supply of engineering educators that there is need for foundation or governmental support of salaries in order to match the opportunities in industry.

CALIFORNIA TECH'S Lindvall also believes that some financial help

(Continued on page 49)

Per Cent of New Teachers with Doctor's Degrees

	1953-54	1958-59	Five-Year Change ↓
Engineering	15.9	15.8	— 0.1
Agriculture	34.9	30.1	— 4.8
Business and Commerce	21.4	11.4	—10
Education	36.5	30.8	— 5.7
Law	31.8	17.4	—14.4
Physical Sciences	53	44.3	— 8.7
Biological Sciences	54.5	49	— 5.5

Per Cent of New Teachers with Less Than Master's Degrees

	1953-54	1958-59	Five-Year Change ↓
Engineering	45.5	42.9	— 2.6
Agriculture	28	32.9	+ 4.9
Business and Commerce	15.9	16.7	+ 0.8
Education	7.6	12.7	+ 5.1
Law	40.9	50.0	+ 9.1
Physical Sciences	14	17.2	+ 3.2
Biological Sciences	5.6	8.9	+ 3.3

FROM WASHINGTON

BY
MILTON F. LUNCH,
N.S.P.E.'s Legislative Counsel

National Goals Commission Established ►

The President's long-pending National Goals Commission has now been established, although it is doubtful that the group will be able to report before the close of the current Administration. Henry Wriston, former president of Brown University, is the chairman, with former Secretary of the Army Frank Pace, now board chairman of General Dynamics Co., as vice chairman. The engineering-scientific community is represented by James Killian, president of M.I.T., and former science adviser to President Eisenhower; James Conant, former president of Harvard and a distinguished chemist, and Crawford Greenwalt, president of E. I. du Pont de Nemours and Co. The President hopes the Commission will "develop a broad outline of coordinated national policies and programs for the next decade and longer."

◄ *Internal Revenue Issues Ruling On Deduction*

Under a new Internal Revenue Service regulation, dues and other payments to an organization which engages in "substantial" activity to influence legislation may not be deductible in full. In such cases, IRS says, deduction will be allowed only for the portion of the dues or other payments which the taxpayer can clearly establish is attributable to activities other than the influencing of legislation. The application of the "substantial" test will be on a case-by-case basis, with no official definition of the key word.

Court Decisions On Tax Status Of Organizations ►

Meanwhile, two recent court decisions shed some light on the question of the tax-exempt status of organizations with respect to legislative activities. In a case involving the League of Women Voters, the U.S. Court of Claims held that a Federal tax on a bequest was properly assessed because the League's activities, even though educational, had the purpose of influencing legislators on public questions. The minority argued that general educational work for the ultimate purpose of influencing legislation was not for a selfish group purpose and therefore should not be construed as being outside the law's exemption for bequests to organizations.

In a New York case involving the same point, the U.S. Court of Appeals (2nd Circuit) decided that bequests to three bar associations were not subject to the tax because the major portion of the legislative work involved "is of a technical nature" and expressed in reports of experts. This type of legislative activity also "avoided questions which . . . turn largely on economic or political decisions. These activities serve no selfish purpose of the legal profession—rather they constitute an expert's effort to improve the law in technical and non-controversial areas."

◄ *Veto Water Pollution Bill?*

It is freely predicted that the first Presidential veto of the current congressional session will be on a bill, passed by both houses, to nearly double Federal outlays for construction of community sewage disposal plants to curb water pollution. As passed, the bill would increase from $500 million to $900 million the Federal contribution to municipalities

on the basis of the Federal Government putting up thirty per cent of the cost. The President wants to eliminate the entire program, but Congress has been putting up about $45 million a year. The new bill would also increase the year-by-year grants from the present ceiling of $50 million to $90 million, and would raise the present $250,000 limit on any one project to $450,000. If the veto develops, there is a fair chance that it will be overridden.

President Against ► Federal Aid To Education

In another hotly debated legislative issue, the President is adamant against the use of Federal funds to help pay the salaries of public school teachers. He stated at a recent news conference that if the Federal Government got into that area it would have to figure out the correct pay for every councilman and all other local officials. "And I . . . can't imagine anything worse for the Federal Government to be into," he added. A Senate-passed bill includes Federal aid for teachers' salaries, but the House version is not expected to go along on this point. The pending House bill, approved by a subcommittee and by House majority leaders, provides $325 million annually for three years for school construction. The Senate bill calls for $917 million annually for three years. Under the House version, states would match Federal grants on a 50-50 basis in the third year, but no matching would be required the first two years.

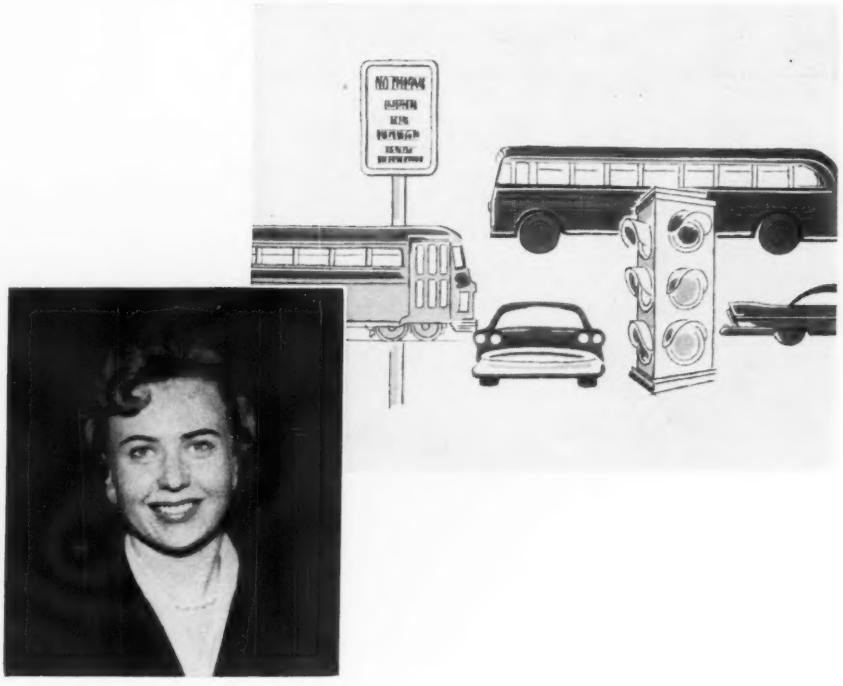
◄ House Committee Hears Testimony On Bridge Clearances

The Blatnik Subcommittee of the House Public Works Committee opened its study of the interstate highway program with testimony on the clearance of bridges with respect to national defense requirements. The initial testimony disclosed that it took from 1957 to late 1959 for the Bureau of Public Roads and the military agencies to confer on the clearance problem. A 14-foot vertical clearance was established when the interstate system was authorized by Congress in 1956. Military agencies later decided they would need a 17-foot clearance to meet problems involved in hauling modern missiles over the highways. Within recent weeks the Bureau of Public Roads raised the clearance heights from fourteen to sixteen feet. Meanwhile, more than 8,000 bridges on the interstate highway system have been built under the old standards.

Wants Auto Industry ► To Install Anti-Air Pollution Device

Senator Richard L. Neuberger of Oregon wants the auto industry to install a device to reduce automobile-caused air pollution on all new cars, starting in 1961. He has objected to an industry plan to offer the devices on an optional basis, except on cars for sale in California on which the device will be standard equipment. The disagreement may become a national legislative issue. The Automobile Manufacturers Association says the device is tailored to the California smog problem. But Sen. Neuberger says that experts estimate the cost of installing the device on the assembly line could be "less than $1." Rep. Kenneth A. Roberts of Alabama, chairman of a House Health and Safety Subcommittee, has invited auto manufacturers to give testimony on why the device should not be standard equipment. The exhaust device destroys unburned hydrocarbons by feeding "blowby"—the mixture of air and raw gasoline that slips into the crankcase past the piston rings—back into the engine. The Public Health Service says it believes the device significantly reduces the discharge of hydrocarbons, but not those hydrocarbons that are suspected cancer-producers.

Professional Profiles



Attractive Ethlyn Ann Hansen, P.E., is employed by the Traffic Department, California State Division of Highways.

THERE might be a dispute about how many model engineers there are, but California can certainly claim at least one.

She is Ethlyn Ann Hansen, P. E., of San Rafael, California. Full time, Miss Hansen is an associate engineer in the Traffic Department of the San Francisco office of the California State Division of Highways. In her spare time, the pretty blonde engineer occasionally performs as a fashion model.

Planning highways and bridges and modeling clothes may seem an unusual combination for an engineer, but Miss Hansen is used to the unusual. She is the only woman to graduate from the Civil Engineering Department of the University of Utah. She was elected president of the Marin Chapter of the California Society of Professional Engineers in December, 1958, to become what is believed to be the first woman to head a local chapter.

Miss Hansen says she took up modeling as an outlet for her femininity. "I wanted to establish a balance in my life to offset the man's world of the job." She took courses at San Francisco's House of Charm at night to learn the art of poise, makeup, and the other necessities of modeling. Today, her duties give little time for modeling, but she still lists it among her hobbies.

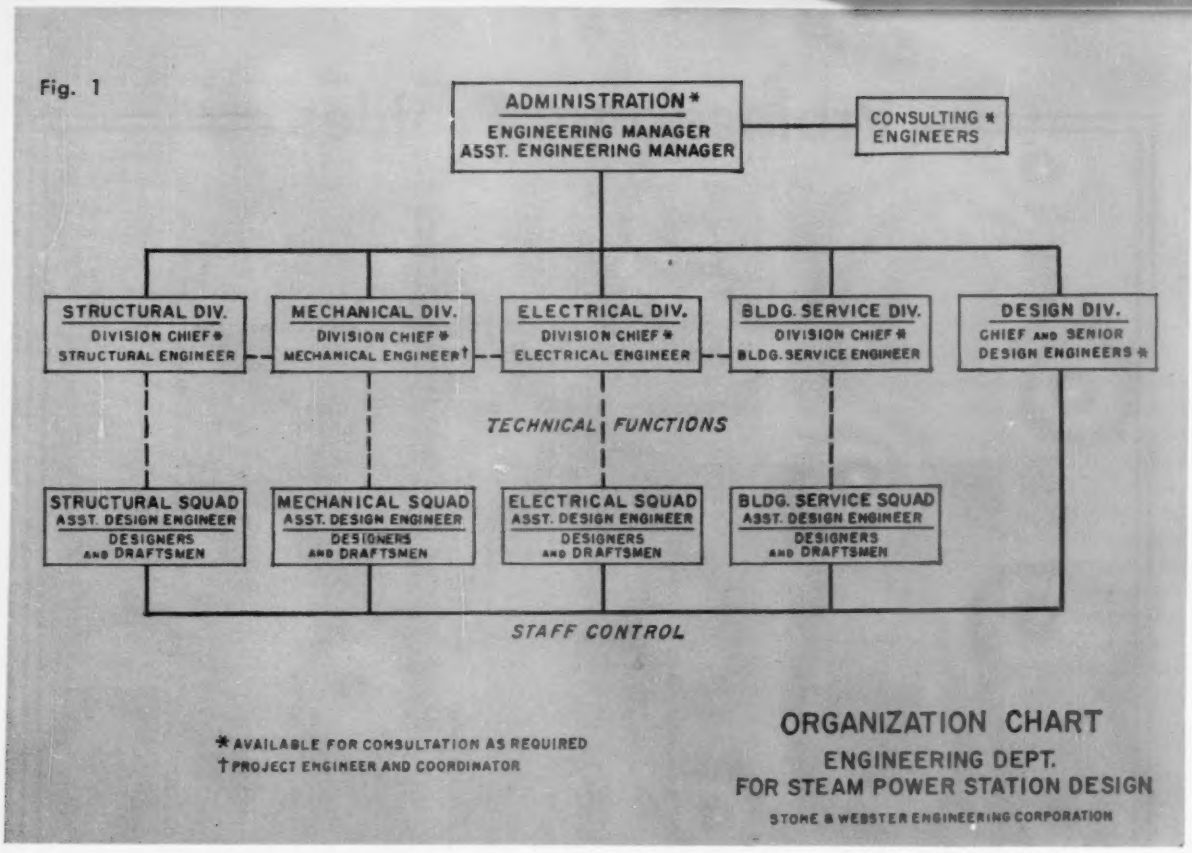
However, engineering has always been her first love. After graduation from the University of Utah in 1951, she joined the California State Division of Highways in the Plannng Department at San Francisco. She worked there for eighteen months before transferring to a design section which included work on all phases of projects costing from $5,000 to $120,000. In September, 1953, she was assigned to the construction department and named office engineer on the reconstruction of the Marin approach to the Golden Gate Bridge, a $6 million project which took two and one-half years to complete. Later she was appointed as inspector for utility relocation and installation, electrical items and fence and concrete curb work on the Marin approach to the Richmond-San Rafael bridge. She is now in the Traffic Department as an associate engineer in San Francisco.

She became a charter member of the Marin Chapter of CSPE in October, 1957, and served as the chapter's finance chairman for one year. She was elected president in 1958 and re-elected to a new term which expires in June of this year. She is also a member of the Institute of Traffic Engineers and is in charge of women's activities for the Western Section Convention to be held in San Francisco in July.

In addition to her professional work, Miss Hansen has also found time to be active in civic affairs and was recently named to the board of directors of the San Rafael General Hospital Foundation.

While attending the University of Utah, she was a member of Chi Epsilon and was historian for the Student Chapter of ASCE. Her parents are Mr. and Mrs. Lawrence Hansen of Salt Lake City.

Fig. 1



A Cooperative Venture: Engineering and Construction

By

J. J. NILAND, P.E.

Assistant Engineering Manager, Stone & Webster Engineering Corp.

MANY variable factors enter into the organization of an engineered construction project. As a result, a great variety of methods are in use. In general, they may be classified by considering two major variables: (1) the extent to which the engineering organization participates in the construction, and (2) the contractual relations between client and engineer-constructor determining the basis of payment of the latter's costs and fees.

Three general categories may be used to define the engineering organization's role in engineered construction:

- *Engineering only.* In this method the client usually lets construction to a general contractor, who, in turn, may employ many subcontractors.
- *Engineering plus management of construction.* Here the engineers provide over-all coordination, direction and supervision, and the actual construction is performed by numerous subcontractors.
- *Engineering plus construction.* In a fully "integrated" project, the engineers undertake construction by force account; that is, employing their own field labor for a major portion of the work, using subcontractors only for specialties.

Different arrangements for payment by the client for engineering and construction fall into two general classifications—cost plus percentage fee (or cost plus fixed fee), and fixed price lump sum.

For construction, there is a third possible arrangement whereby unit prices are fixed, such as dollars per cubic yard of concrete, and the total payment is determined by the final total of units actually placed.

It is not the intention here to discuss the relative merits of any of these arrangements but rather to point out their pervasive influence on how engineering and construction are managed. For example, if the integrated engineering plus construction method and the lump-sum payment arrangement are combined, the so-called "turn-key" project is obtained, in which the engineering organization under-

takes for a fixed price to deliver a complete installation.

There are two requirements affecting engineering that follow from such an arrangement: (1) The engineers must be prepared to provide a completely integrated service, including all aspects of engineering, purchasing, construction and preliminary operation. (2) For the protection of both parties, the engineers must proceed with the design exactly as described in their proposal, incorporating client's changes only after negotiating "extras."

Again, if the engineers perform engineering only, with construction by a general contractor on a lump-sum basis, it follows that all drawings and specifications must be ready at the same time, in order to take bids on a presumably correct scope of work. Changes would again involve "extra." Construction can not begin until engineering is substantially complete.

In public-utility work performed by Stone & Webster Engineering Corporation, the typical project consists of an integrated design and construction assignment, undertaken on an agency basis. The engineer-constructor is in all matters the client's agent, with complete identity of interests. Costs are for the client's account and a single fee covers both engineering and construction. From this it follows that:

(a) The client has control of the project, to whatever extent he may elect, in all of its stages.

(b) Engineering and construction may be closely scheduled, with construction beginning very shortly after the project is authorized.

(c) Early completion dates are possible, and much emphasis is placed on this since only after the unit starts producing does the client's investment start to pay a return.

These considerations establish the scope of the engineer's task, and the background against which it is performed.

Examination of some of the managerial problems involved in planning such a project can be facilitated by reference to a particular project. The third unit of the Salem Harbor Power Station of the New England Power Company shown in Fig. 2 was selected as representative of good modern practice.

The New England Power Company is a member of the New England Electric System. So also is the New England Power Service Company, an organization that performs engineering and construction management for member companies.

On the Salem Harbor project, Stone & Webster was selected to work closely with the Service Company. The engineering was divided between the two organizations and Stone & Webster provided direction, coordination and supervision of construction.

The division of effort required careful delineation of procedures since the arrangement was not a typical one for either company.

Stone & Webster's share of the engineering was as follows:

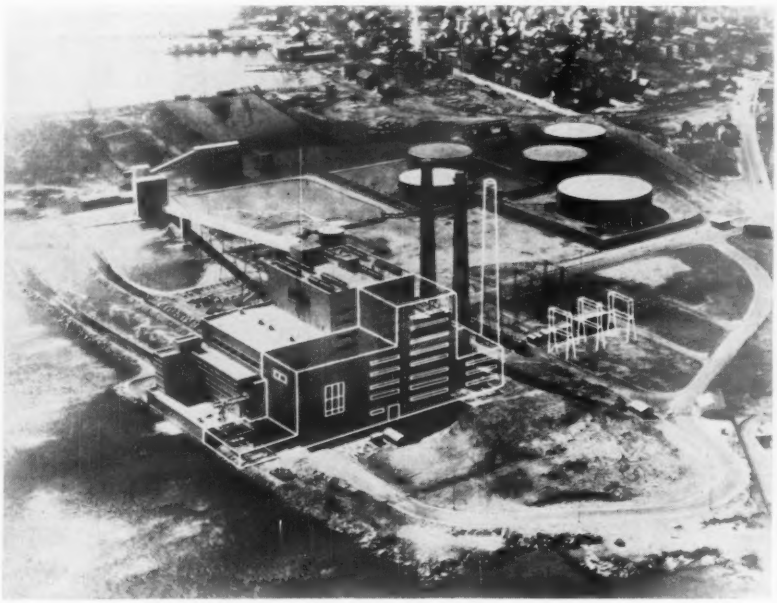
Mechanically. Steam and feedwater-cycle analysis and recommendation, preparation of equipment specifications and recommendations for selection of all major equipment, (except for the general service and coal-handling systems) design of all major piping systems, including high-pressure, reheat, and extraction steam, plus boiler feed and condensate lines.

Electrically. All power distribution and wiring within the station from the 2300 and 440-volt switchgear inward, turbine and boiler controls and interlocks, station lighting and preparation of specifications for the low-voltage equipment.

Structurally. Boilerhouse structural steel and turbine support.

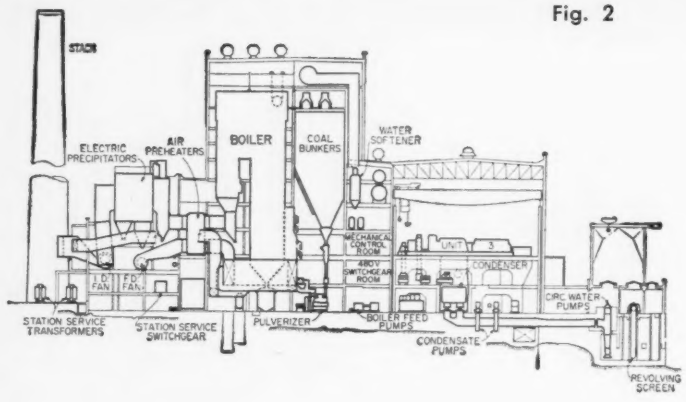
Fig. 1 shows the organizational setup on a typical Stone & Webster power-plant project. The Engineering Department is organized on functional lines, with all mechanical engineers reporting to the chief mechanical engineer, and similarly in other divisions. The dotted lines represent the relationships of the various individual engineers in the different divisions who are assigned to the particular project.

One engineer is selected as the project engineer and given responsibility for the satisfactory coordination of engineering and for the total cost, with the exception of field-incurred costs controlled primarily by the construction depart-



This air view of the Salem Harbor Station of the New England Electric System showing the outline of Unit #3 symbolizes the planning concept involved in the design and construction of generating facilities.

Fig. 2



LONGITUDINAL ELEVATION

NEW ENGLAND POWER CO.—SALEM HARBOR STATION—UNIT 3

ment. On steam power-plant projects, this is usually the mechanical engineer. The electrical, structural and building service engineers do not report to him but to their respective division chiefs.

Basically, the relation between engineers is one of cooperation on a horizontal level. In rare cases where a difference of opinion occurs between the project engineer and an engineer from another division, the project engineer's decision is usually accepted. If it is not, he has recourse to his division chief who, in most cases, will resolve the disagreement with the head of the other divisions. If agreement should not be reached at this level, the division chiefs, in turn, may bring their problem to the engineering manager. It might be added that this is almost never necessary.

THIS seemingly loose definition of the project engineer's authority works extremely well in practice. This is a typical example of those cases where an "organization chart" enthusiast can be led astray by thinking in terms of lines on the chart. The real organization consists of an ingrained philosophy, in this case a long tradition of cooperation between individuals and divisions.

The Design Division, which produces the design drawings, is also organized on functional lines into mechanical squads, electrical squads, etc. Administratively, the squad leaders report to the chief design engineer rather than to the project engineer, although they receive technical direction from their respective engineers.

The division of effort between the New England Power Service Company and Stone & Webster on the Salem Harbor project made it desirable, as a first step, to draw up a special organization chart showing the relations between the two. Statements here refer primarily to the problems of the Stone & Webster project engineer. It must be understood, however, that on this particular project his recommendations were subject to review by the New England Power Service Company's project engineer, and decisions were reached jointly.

Decisions as to where to add capacity and how much are arrived at after load-growth studies conducted by the power company, sometimes with the assistance of outside consultants. Although Stone & Webster often is called upon to render this type of consulting service, in the case of the Salem Harbor unit, the size of the addition, approximately 150,000 kw gross capability, and its location at the Salem Harbor plant were determined before Stone & Webster's engineering-construction services were engaged.

Once the scope and approximate timing of a project are understood, a conference is held between representatives of the engineering and construction departments where a tentative construction schedule is presented for consideration. This schedule is geared to certain key dates, such as the desired commercial operating date and promised boiler and turbine-generator delivery dates.

In recent years, in cases where the turbine-generator has been ordered sufficiently early, the schedules have hung on the following framework:

1. Operating date.
2. Time for boiler erection, test and preliminary operation.
3. Time for erection of sufficient structural steel to hang boiler drum.
4. Time for delivery of steel from issue of steel drawings correct for mill order.
5. Time for development of sufficiently accurate layouts to permit design of structural steel.

Although this skeleton usually determines the over-all calendar length of the construction schedule, there are obviously many other items to be considered and shown in their proper relationship.

Close coordination between the engineers and the construction department is required at this point. Engineering will be most efficient if no detailed design is begun without complete information including client's decisions on the many basic alternatives that must be considered.

Construction will be most economical if a steady and orderly growth in man-hours is maintained and shift work and excessive premium time can be avoided. This means that the bars on the schedule should be of the proper length and not all stacked vertically at the right-hand end.

Once the construction schedule

has been established, it becomes the framework on which all other schedules are based. A drawing schedule, listing all design drawings required, is prepared with each drawing dated to meet construction requirements, allowing the proper lead time for purchasing materials. Approximately 850 drawings were required for the Salem Harbor Station. The various division engineers prepare engineering schedules showing when each specification will be ready and indicating the dates on which bids will be taken and purchase orders placed. All of these schedules are issued at monthly intervals showing the actual progress achieved and measured against the scheduled requirements.

At the peak of the engineering activity, there may be as many as fifty engineers, designers, and draftsmen actively engaged on a project such as Salem Harbor. The project engineer is responsible to his management for the cost of the job insofar as it is affected by engineering. If he is to discharge this responsibility adequately, he must be kept informed of the progress being made and the trends of actual costs.

The client's over-all financing arrangements are usually based on a preliminary estimate. At a fairly early stage, this is superseded by an official estimate issued by the Estimating and Cost Department. Accompanying this estimate is a description that defines the scope of work in detail.

Since this estimate is often used by the client for determining the exact extent of final financing required, great care is used in keeping it up-to-date.

When a change is requested by the client, it is described and a cost estimate shown in a supplemental "authorized change order." This enables the client to determine whether the proposed revision is economically justified. Reports of status of estimate are issued monthly, showing expenditures versus estimates, segregated by accounts.

Expenditures required to complete the project are re-estimated at 3-month intervals, and anticipated total costs compared with the official estimate. In this way, potential overruns become evident at an early date when action may still be taken to avert them.

The cost of the engineering itself is usually a small part of the total cost, but nevertheless its control is properly considered a measure of the efficiency of the engineering organization. Estimates of the number of man-hours required for engineering and design are prepared at the start of the job.

Monthly progress reports, Fig. 3, showing per cent of work accomplished versus per cent of estimated time spent are reviewed by the project engineer and the engineering manager. The use of machine accounting methods makes the compilation of such reports relatively simple, and they perform a valuable service in keeping engineering management in touch with the status of all jobs.

Establishing the basic design of a steam-electric power station is essentially a process of sifting many alternatives, until the best combination is found. Time and effort spent on this phase can pay rich dividends in lower total cost of the project, more effective performance of the facility and thereby lower cost per unit of production.

Comparisons of alternate designs will be greatly affected by the client's "fixed charge rate" on the sum of amortization charges, interest on debt, insurance, taxes, and desired earnings on equity capital.

The intended annual capacity factor of the unit, and the client's evaluation of how much each added kw of capability is worth, will also have considerable influence on many of the fundamental decisions.

With these ground rules established, the general design of the plant can proceed. An engineering and economic study of the various possible station steam and feedwater cycles is undertaken by a group of engineers who specialize in this work. Alternative cycles are compared and the one most suitable to the particular installation in terms of fixed versus operating costs is recommended.

While this work is in progress, the engineers cannot lose sight of the construction schedule. Specifications for long-term delivery items must be issued promptly, bids taken and analyzed, recommendations made to the client and orders placed.

Arrangement drawings of the

(Continued on page 52)

Fig. 3

STONE & WEBSTER ENGINEERING CORPORATION

ENGINEERING PROGRESS REPORT

J.O.No. _____ Job Name _____ Date of Report _____

DIVISION	Original Estimate (Hours) (1)	Revised Estimate (Hours)	Performance in Hours: Used to Date (3)	To Complete (4)	Total Req'd (5)	% of Hours Used: To Date (6) Col. 3 / Col. 1	Complete (7) Col. 3 / Col. 5
Mechanical							
Structural							
Electrical							
Building Service							
Industrial							
Hydraulic							
Design							
Consultants							
Administrative							
Total							

DESIGN PROGRESS REPORT

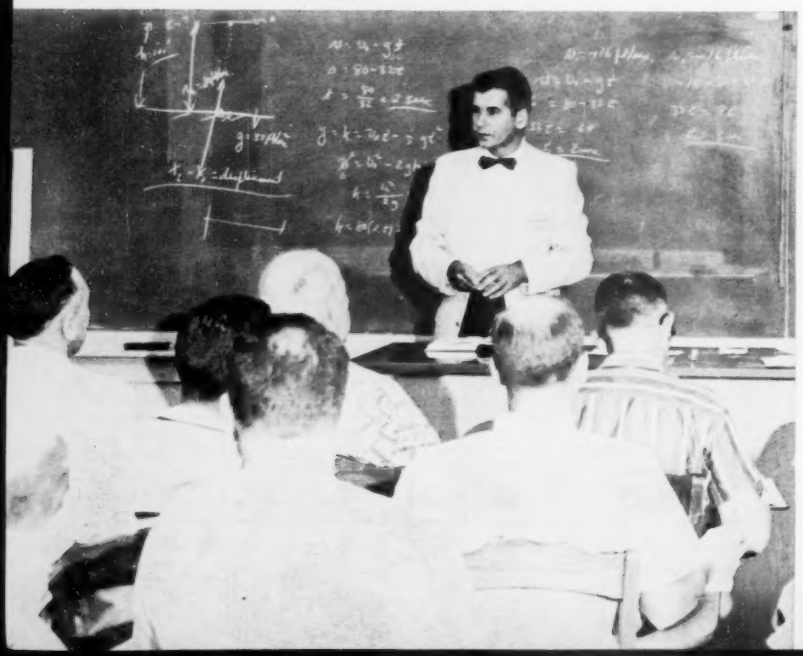
J.O.No. _____ JOB NAME _____ WEEK ENDING _____

ACCOUNTS AND DIVISIONS	ORIGINAL ESTIMATE (1) HOURS	No. DWGS.	ORIGINAL ESTIMATE + EXTRAS (2) HOURS	No. DWGS.	% ON BASIS COL. (3) / COL. ( )	PERFORMANCE HOURS USED (3)	HOURS TO COMPLETE (4)	TOTAL HOURS REQUIRED (5)	% AT COMP. IN COL. (5) / COL. ( )	DRAWINGS SCHED.	ISSUED	% COMP.
INSTRUMENTS												
FLOW DIAGRAMS & P&I PLANS												
PIPING												
PIPE HANGERS												
INSULATION												
PRESSURE VESSELS												
MECH. AND PROCESS-TOTAL												
BUILDING SERVICE												
ARCHITECTURAL												
CONCRETE												
STEEL												
STRUCTURAL - TOTAL												
ELECTRICAL												
PROBATED												
GRAND TOTAL												

Headquarters of the National Science Foundation is located in Washington, D. C. From this building, the NSF directs a variety of programs, ranging from promotion of engineering and scientific education to the support of basic research. Most of the NSF activity is in the form of administration of grants to institutions and individuals to carry on research throughout the nation.

• *An AE Photo Story* •

One of NSF's most important functions is the support of various teacher institutes which are designed to assist instructors to improve their subject-matter knowledge and to keep abreast of new developments in their fields. Here a group of teachers hears a lecture by Professor Robert S. Wilson, academic director of the physics section of the Summer Science Institute at Ripon College.



National S
Many Imp

SINCE World War II, and particularly since the advent of the Space Age, the Federal Government has taken an increasing interest in the development of the nation's engineering and scientific capabilities.

As part of the realization of the government's responsibilities in these important areas, the Congress in 1950 established the National Science Foundation "to advance the national health, prosperity and welfare; to secure the national defense; and for other purposes."

Under this rather imposing and broad statement of purpose, the NSF today carries on a variety of programs ranging from promotion of engineering and scientific education to the support of basic research. Also included in its myriad of functions are programs for the improvement of mathematics and scientific curricula in high schools, the dissemination of scientific and engineering information, as well as grants for such major undertakings as the National Radio Astronomy Observatory now under construction at Green Bank, West Virginia.

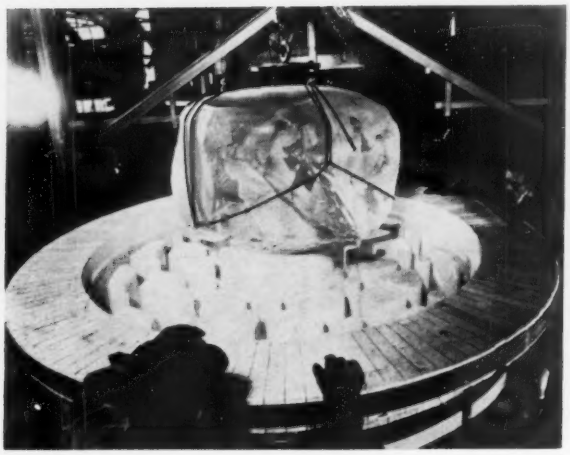
While much of the NSF work is directed toward support of basic scientific research, engineers and the engineering sciences have important areas of interest in the Foundation program.

Some of these benefits to the engineering profession come through NSF's support of major research facilities at universities and colleges throughout the country. This has included partial financial support for nuclear reactor and electronic computer centers for these educational institutions. During 1959, NSF allocated $12.3 million for support of facilities for research in the mathematical, physical and

(Continued on page 32)

cience Foundation Sponsors
ortant Engineering Programs

Research . . .

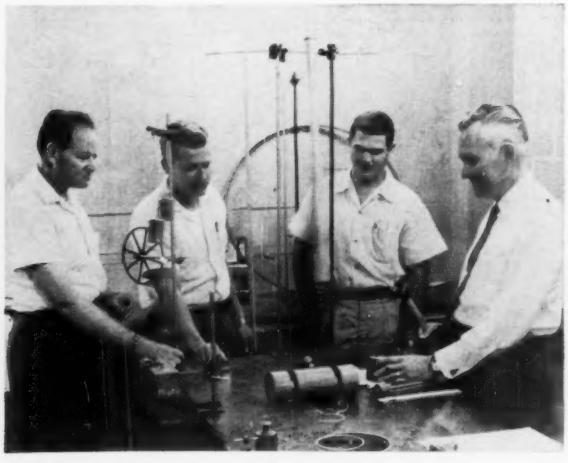


A giant reflective piece for the Kitt Peak National Observatory in Arizona is shown under construction at the Corning Glass Works. The Kitt Observatory is one of NSF's major support projects for research facilities.

Experiments . . .

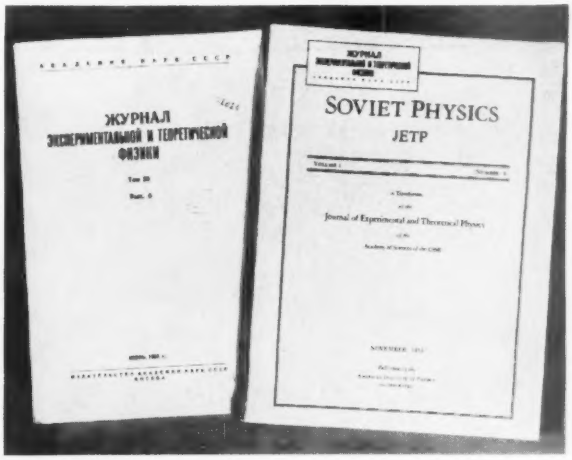
Promotion of interest in the sciences is a principal job of the National Science Foundation. Here Dr. Herbert Alyea, professor of chemistry at Princeton, conducts an experiment before an audience at East Tennessee State College.

Institutes . . .

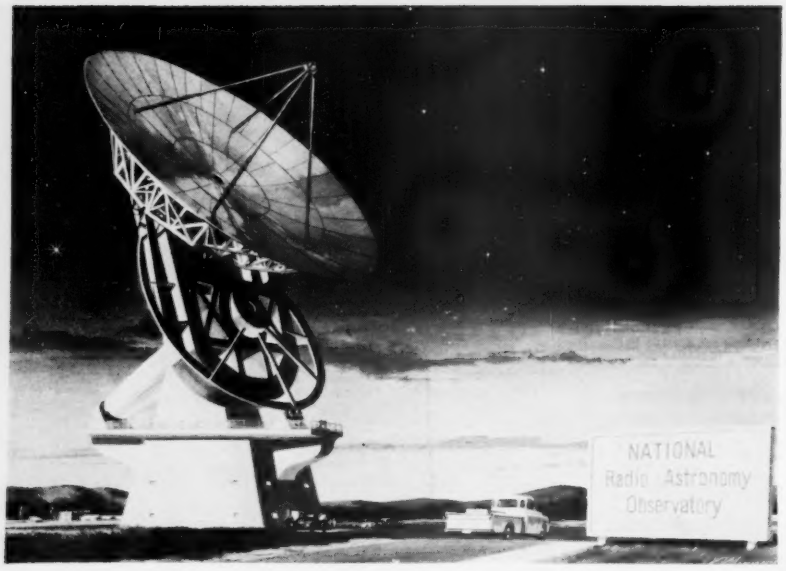


Physics teachers study the principals of pendula at a Science Institute sponsored by the NSF at the University of Arkansas last year.

Education . . .



Translation of foreign engineering and scientific documents and journals is another function of the NSF. Last year the Foundation participated in the translation of more than 70,000 pages of foreign material.



Above: A listening post for messages from outer space is being constructed at Green Bank, West Virginia, under contract from the NSF. The project, known as the National Radio Astronomy Observatory, will be one of the largest precision research instruments in the world.

Right: One of the thousands of NSF Fellows who have done graduate study in engineering and science on fellowship grants from the Foundation. In 1959, the NSF provided $13.1 million for more than 3,900 fellowships.

Below: Skyhook balloon towers over the launching crew on the USS Valley Forge in the Caribbean. The balloon, one of the largest ever launched, carried gondolas containing emulsion to capture high energy cosmic rays for study. The project was sponsored by the NSF.

engineering sciences. The funds included grants for research reactors at Texas A&M College, Georgia Institute of Technology, University of Buffalo and Cornell University and the establishment of computer centers at North Carolina, Oklahoma, Yale, Iowa State, and Cornell.

From its inception, NSF has conducted a number of programs in the field of education, many of which are either directly or indirectly related to the advancement of the engineering sciences. As part of this program, thousands of NSF Fellows have completed graduate study in engineering and science with Foundation support. In 1959, NSF provided $13.1 million for more than 3,900 graduate fellowships.

In addition to its fellowship support, NSF has important programs of science-manpower support, teacher training institutes, curriculum-improvement projects, and special programs in science education.

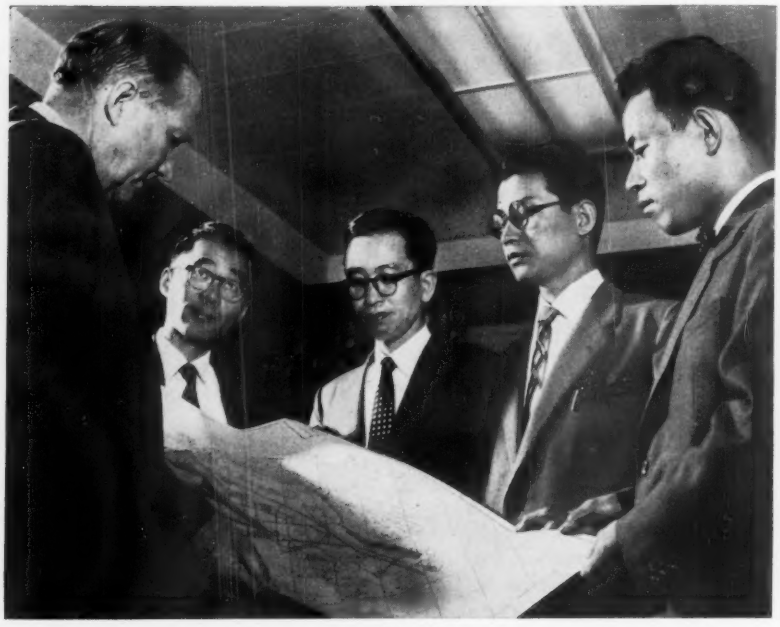
One of NSF's most rapidly expanding functions is the support of various teacher institutes which are designed to assist instructors to improve their subject-matter knowledge and keep abreast of new developments in their fields. The institutes originate with the universities and colleges and are

(Continued on page 54)

Part III Concludes this Outstanding Article on Engineering As a Profession by Admiral Rickover. Reader Comment of the First Two Installments Has Been Praiseworthy, Indeed; Don't Miss His Final Observations!

The Meaning of Your Profession

By
VICE ADMIRAL H. G. RICKOVER
Chief, Naval Reactor's Branch
Division of Reactor Development
U. S. Atomic Energy Commission



Consultation with experts should be a common thing, says Admiral Rickover. Here, four Japanese aviation engineers studying in the United States under the Government's Technical Assistance Program, receive advice from Earle M. Rader, left, senior partner of Rader and Associates.

Part III

THE GREEKS were the first to put the expert in his place. They tore away his mantle of mystery; they denied that knowledge was a special dispensation reserved by the Gods for particular groups of people. They threw open the door to knowledge and made its acquisition the supreme civic and human virtue.

They looked upon the universe and man's relation to it as a proper object of study for *all* men. They believed that everything could be understood by the right kind of intellectual technique. To know, man first had to observe, then to collect and order his observations; finally to discover what were the underlying, the basic principles in the mass of information on hand. Hard thinking was necessary, but it brought its reward: for once known, these principles could then automatically be applied to new problems. The result might be described as an intellectual chain reaction. It goes far to explain the amazing accomplishments of the ancient Greeks.

Their approach to learning was secular and intellectual; it was rigorous in its insistence on logical deduction from *verifiable* facts. All that was needed to transform this intellectual technique into our modern scientific method was ability to experiment; and the necessary tools. Experiments merely widen the sphere of human observation; they permit pinpointing inquiry on specific objects and they bolster deduction through verification by "controlled" tests. Without laboratories and accurate scientific tools, the Greeks yet were able to create sciences out of conglomerations of unrelated bits of knowledge which had been long possessed by many other peoples. Thus, they founded a science of mathematics, of astronomy, of medicine, of history. They gave the West a scientific habit of mind.

Having thought their way out of the then universally prevalent custom of confusing knowledge with divinely sanctioned magic, the Greeks were bound to reject any claim by experts that their special knowledge justified a privileged position. In the political

field, this meant rejection of the claim that certain persons had a divine right to be rulers. And so the Greeks were the first civilized people to establish popular rule. Their type of democracy was based on the belief that average Athenians, for example, were quite capable of governing themselves. Not only as legislators, but even as government officials. Greek democracy required direct participation in government by all adult males. Each was a member of the Assembly and took turns for set periods of time at serving his city as soldier, magistrate, judge and priest. The smallness of the Greek city-state simplified the art of governing, and the absence of a priestly caste in Greek religion permitted lay performance of religious functions.

But this would not have been feasible without a relatively high level of education. And indeed the Greeks were a literate people. For after all, free access to knowledge was the basis of their way of life which differed so radically from that of the people surrounding them; people who were enslaved by their own ignorance of any except purely practical knowledge. Though a Greek city-state such as Athens did not provide free schooling, the obligation of parents to provide for their sons' education was well understood and accepted. Solon is credited with having hit on a clever device to give sanction to this moral obligation. He released sons from the filial duty to take care of their fathers in old age, if the fathers had not made provision for their sons' education!

Athens in 400 B.C. appears to have had fewer illiterates than many "advanced" nations in 1800 A.D. Moreover, almost anybody could broaden his mind by attending the theatre which in Athens had distinctly educational aims besides that of entertainment. "Recreation for the spirit" was available in abundance; one could listen to the philosophers as they wandered about with their pupils, discoursing learnedly and wittily on practically every question or problem known to preindustrial man; in this pleasant manner one could absorb ideas about truth and beauty which have inspired men ever since. Athens was permeated by a love of learning which most of us would consider excessive. There were eggheads galore and oddly enough the Athenians respected them. They even put up with a man like Democritus when he uttered the following weird sentiment: "I would rather discover one scientific fact than be King of Persia."

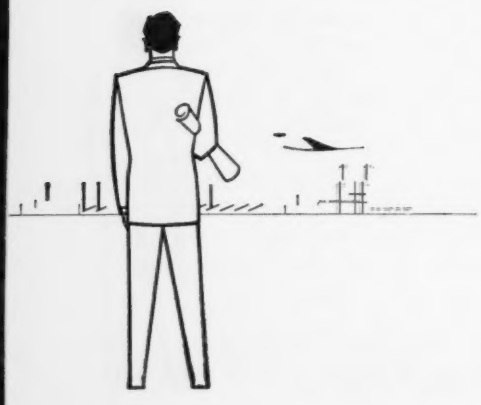
PERHAPS the most remarkable aspect of Greek democracy was that it did not lead to a cult of mediocrity. On the contrary, education of the young was designed to bring all their faculties to fruition—the suppleness and beauty of their bodies through athletic games, the perceptivity and sharpness of their minds through dialectics—what we would call "public speaking." As Pericles expressed the Athenian ideal, government is in the hands of the people, the law secures equal justice for all and "as for social standing, our practice is that a citizen who has recognized ability in some field gets public preferment—IT IS A QUESTION OF HIS ABILITIES, NOT OF HIS RANK."

It is the fashion today to deprecate the value of classical civilization for modern man; but I myself am constantly struck with the lasting validity of so much of what the Greeks and Romans thought and wrote. These thoughts are at the origin of many of our most treasured traditions. Greek political ideas greatly influenced the founding fathers and helped them to devise for us a most marvelous constitutional framework. The Greeks paved the way for modern science, while the Romans still influence the law under which all the people of the West live to this day. It is not too fanciful to consider a modern engineering college a remote descendent of the Greek medical school at Cos or the Roman legal school at Beirut, or even Plato's Academy and Aristotle's Lyceum in Athens. If I had the time, I could make a pretty good case for this distant relationship.

It is true that Greek and Roman civilization was based on slavery and that some of their habits and practices were rather odd. Much is made of this by anticlassicist "progressives." And it is also true that outwardly a modern technological society seems to have little in common with Rome—still less with the tiny preindustrial Greek city-state. Yet human problems have a way of persisting unchanged through the most revolutionary permutations of man's environment. The product of clear, logical thought has permanent value. It is, as Thucydides put it, a "possession forever."

Nowhere is this more clearly evident than in the lasting validity of Greek thought about the role of the expert—the professional man—in society. The Greeks evolved the concept that, far from entitling him to a position of power, the possession of specialized professional knowledge actually imposed on the expert a special obligation, namely to use this knowledge solely for the good of others. This concept is foreign to most other civilizations, except when they have deliberately adopted it from the West. It is, of course, basic to the

(Continued on page 50)



Editor's Note:

Much of the material in this article can be found in the Admiral's latest book entitled *Education and Freedom* published by E. P. Dutton & Co., New York, N. Y., Copyright, 1959. Royalties from the book and payments for speeches and articles are donated by the author to various charitable organizations.

It's Cool, Man!

SURVEYING IN ALASKA

A YOUNG man of active disposition, looking for a life of adventure in this day of vanishing frontiers, might consider the work of surveying in Alaska.

For that matter, there's a future to his liking in any of the various professions connected with site-locating for military installations, like materials engineering and geology.

Some such men and, there has been one hardy woman involved, are doing their jobs in parts of the most remote primitive country left on the continent.

They are employed by the U. S. Army Engineer District, Alaska. The work has been in progress since late last fall at locations dotting Alaska from southeast to the north-central. Most of the sites are in roadless country selected with its strategical importance as the paramount consideration.

Reports filtering back from sites indicate conditions resembling something out of the diaries of Lewis and Clark except there are no unfriendly Indians.

Moose are seen often. They are friendly or unfriendly as the mood hits them. Other long-time residents of Alaska are seen frequently like wolf, ptarmigan, caribou and the wily wolverine.

A young man mapping a life of adventure might think this is something less than adventure, but he would be disagreeing with the majority opinion of veteran site men of the District. The game animals are one of the high points of the job, they say.

An applicant for a career like those listed needs considerable technical proficiency, a rugged physique and an ingenious turn of mind to outwit the gathered forces of nature. The usual thing is either wind, cold or rugged terrain or all three.

John Gerwels, District field survey section chief, took a liking to the work of surveying remote Alaska thirteen years ago and is still going strong. His liking for the job hasn't diminished in that time despite the rugged aspect.

He warns those now considering the work—

"It is more appealing on paper than in the field to many."—**End.**

Sidehill Survey . . .

Tall View of Rugged Country . . .

Mountain Climbing . . .

New Literature

HOME INSULATIONS—A definitive reference manual on home insulations for use by architects and designers, builders, contractors, dealers and others interested in the part insulation plays in residential comfort and economy, has been published by Owens-Corning Fiberglas Corporation. The 24-page booklet offers, for the first time under one cover, design principles, design standards, application standards, tabulated data and product information. Under design principles, the booklet covers insulation, ventilation, condensation control and sun heat control. It also defines design standards and specifications relating to amount of insulation, structural ventilation, techniques of condensation prevention and of sun control. In addition to general notes on thermal design, the manual offers specific information on the insulation of roofs and attics, sidewalls, floors, crawl spaces and basements. The booklet also contains heretofore unpublished data on heating and cooling operating costs and statistics on year-'round climate for sixty-five cities.

(Circle 15 in Readers' Service Dept.)

PENTA PRISM—The effects of changes in Penta Prism position and alignment in optical tooling techniques is graphically described in a 20-page booklet prepared by Engis Equipment Company. This new booklet illustrates the behavior of the Penta Prism in its varying applications and provides important data for designers and engineers employing modern optical tooling techniques. The illustration shows the effect of prism rotation. The photograph shows a Penta Prism as enclosed in an optical square.

(Circle 16 in Readers' Service Dept.)

OIL COOLER—The Young Radiator Company announces the release of a completely new Oil Cooler catalog. The 10-page, 2-color catalog lists complete data on Young oil to air and oil

to water oil coolers for torque converters, industrial applications and marine transmissions. Information includes descriptions and photos on mobile and stationary applications up to 600 h.p., advantages of Young construction features, diagrams of oil to air coolers including dimension tables, fan specifications and performance graphs. An analytic description of single-pass and two-pass liquid cooled shell and tube torque converter coolers complete the catalog.

(Circle 17 in Readers' Service Dept.)

ORDER GUIDE—Alden Products Company, Brockton, Mass., offers a newly revised Quick Order Guide to help design engineers plan and package circuitry. The 20-page booklet lists off-the-shelf components used in making up complete electronic systems. Also offered is a new brochure, "Alden Basic Building Blocks," which graphically describes the Alden method of modular construction of electronic units from off-the-shelf components.

(Circle 18 in Readers' Service Dept.)

CONTROLS—A new 1960 Mercoid Control catalog has been released with fifty-six informative pages. The catalog lists mercury switch equipped controls for single stage pressure, two-stage pressure, differential pressure, single-stage temperature, two-stage temperature, liquid level and mechanical movement. Also illustrated are transformer-relays and a complete line of hermetically sealed mercury switches. Each control with accompanying description, specifications and engineering data, can be easily located by a dual index in the catalog.

(Circle 19 in Readers' Service Dept.)

COMPRESSORS—A 24-page bulletin describing the WN-114 stationary compressor has been released by Joy Manufacturing Company. The new booklet includes specifications on three basic models of the semi-radially constructed units ranging from 1385 cfm at 125 psi. Vital information on "package" design, components, intercooling, lubrication, motor mountings, and accessories are fully illustrated and explained.

(Circle 20 in Readers' Service Dept.)

TUBING—A booklet on stainless steel tubing is now being distributed by Allegheny Ludlum Steel Corporation. The new 34-page booklet gives details on the various sizes, grades, design data, corrosion resistance, and other information valuable to industries interested in both welded and seamless stainless steel tubing. More than twenty-five tables on stainless steel tubing are included, along with photographs and other drawings and data. A special section on composite tubing is also included.

(Circle 21 in Readers' Service Dept.)

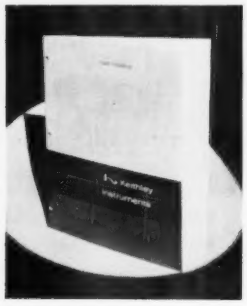
It's New...It's Quicker...It's Better!

What? The AMERICAN ENGINEER's enlarged Readers' Service Department

Now you can get more information about any ad in the magazine or more data on any "Progress in Products" item, or literature listed in "New Literature," in a matter of days! Look inside the back cover.

Hundreds of Our Readers Take Advantage of This FREE Service Every Month!

INSTRUMENTS—The Keithley 1960 catalog describes and illustrates instruments for electronic, biological and chemical measurement and control. Specifications and performance data



are included for the complete line of instruments, including the newest additions: Model 603 Differential Electrometer Amplifier, 250 Static Meter, and Model 240 Regulated High-voltage Supply. Schematic diagrams and application circuits, as well as basic information on electrometers and micro-microammeters, are included in the 32-page reference catalog for advanced research and production instrument users.

(Circle 22 in Readers' Service Dept.)

PUMPS—A comprehensive 72-page catalog giving full design details and operating characteristics on the company's complete line of hydraulic pumps, fluid motors and valves has been published by the Denison Engineering Division, American Brake Shoe Company. Special sections in the publication are devoted to each of the following: hydraulic pumps, axial piston type; hydraulic pumps, vane type; pumping units; fluid motors; axial piston type; fluid motors, vane type; four-way directional control valves; check valves; electro-hydraulic pressure control valves; pilot operated pressure control valves; surge damping valves, and flow control valves. Each section discusses the design and operating characteristics of the components involved, with cut-away illustrations in color. Accessory controls for each model are also illustrated and discussed. Joint Industry Council symbols are used throughout the catalog, closely adjacent to each product discussion, to simplify the preparation of plan drawings incorporating specific hydraulic components. Tables of typical performance data for individual pump or control units are included in the catalog.

(Circle 23 in Readers' Service Dept.)

TUBE FITTINGS—A 44-page catalog which contains a wealth of technical data and fully describes the complete Hi-Seal butt-joint fitting line is now available from The Imperial Brass Manufacturing Company. The new catalog contains much vital technical data which is of value to any engineer connected with tube circuitry. It contains over 250 additional styles and sizes. It includes first printed material on Braze-Seal Fittings for extra high pressure and temperature. There are sections on pressure, vacuum, temperature, vibration, corrosion resistance, port seals, flow and velocity characteristics along with laboratory reports and complete assembly instructions. Styles, sizes and materials on Hi-Seal stock items are listed in an easy-to-follow manner with complete dimension data on each type. Listing includes assorted fittings, valves, hose couplings and the special filter tee for continuous gas analyzation in chemical plants, refineries, hydraulic work, and pneumatic systems.

(Circle 24 in Readers' Service Dept.)

CONSTRUCTION—The 1960 edition of the *Masonite Construction Manual*, which contains sections on exterior and interior uses of Presdwood, has been released by Masonite Corporation. The 28-page manual is printed in two colors and is illustrated with detailed drawings. Descriptions of the various products, table of properties, list of available sizes, directions for working with Presdwood and application details are included in this year's manual. Complete product information also is included on two new interior products—the Panelok wall system and new Royalcote Cherry panels.

(Circle 25 in Readers' Service Dept.)

TESTING—Environmental test equipment that duplicates global climatic conditions—test cabinets large and small—baths, ovens, steam-humidity chambers, and bacteriological incuba-

tors are among the instruments described in a new catalog published by the American Instrument Company, Inc. Hundreds of devices are included, all for the precise control of temperature and humidity in the modern laboratory. The catalog includes forty-one pages of illustrations, descriptions, applications, and a temperature conversion chart from C to F, or F to C. A list of the sales engineering offices located throughout the USA is also included as a ready reference.

(Circle 26 in Readers' Service Dept.)

CHAIN AND SPROCKETS—The most extensive line of roller chain and Taper-Lock sprockets ever offered by Dodge Manufacturing Corporation is presented in a new 56-page bulletin. Complete with selection data and list prices, the bulletin also includes general information on the installation of roller chain drives, calculation of center distances, horsepower ratings, conveyor engineering, and instructions for lubrication and maintenance.

(Circle 27 in Readers' Service Dept.)

BLADES AND SAWS—A product information folder and a price list on new Truco masonry and concrete saws and blades are now available from the Truco Masonry Drilling Division, Wheel Trueing Tool Company. The literature describes the company's newly-expanded line of masonry cutting equipment, including abrasive and diamond blades, heavy-duty masonry saws, concrete cutting saws, a standard masonry saw, and a stone cutting saw.

(Circle 28 in Readers' Service Dept.)

These listings are informational only and are not an endorsement of the products, nor of the manufacturer's claims. To receive any of the new literature described in this column, merely circle the item number in the Readers' Service Dept. and mail to AMERICAN ENGINEER.

Strictly Business

Personalities . . . **E. W. Hollister** has been appointed manager of **The Austin Company's** 12-state Cleveland district. He succeeds **C. W. Wolfe** who will remain with the company as a vice president . . . **William L. Strait** has recently joined Texaco, Inc., Port Arthur, Tex., as a civil engineer . . . **Russell S. Fling,** consulting engineer, has announced that **Gunnar Eeman** has become an associate engineer in the firm under the new name of **Russell S. Fling & Associates,** Columbus, Ohio . . . **Paul A. McDonald** has been appointed district manager for the States of California, Nevada, Utah, and Arizona by the **Koehring Division** of **Koehring Company,** Milwaukee, Wis. . . . **Frank K. Armour** has been appointed chief engineer of **Interlake Iron Corporation,** Cleveland, Ohio . . . **Paul Van Ael** has joined the engineering staff of **Soiltest, Inc.,** Chicago, Ill., it has been announced by **Theodore W. Van Zelst,** president. He will be in charge of the company's engineering program in Europe . . . **Alexander Allison, Jr.,** has retired as an engineer for the Sewerage and Water Board, New Orleans, La. . . . **James W. McConaghy** has been elected vice president for product development of **The F. E. Myers & Bro. Co.,** Ashland, Ohio, it has been announced by **Curtiss Ginn, Jr.,** president.

Mr. Hollister

R. P. Bridges has been named chief engineer, interrupting equipment, at the **Hubbard and Company** electrical research laboratory, McCook, Ill. . . . **Charles Bruns, John Stanley, James Hursh,** and **Richard Kingston** have been appointed regional engineers by the **Edwards Company, Inc.,** Norwalk, Conn. . . . The appointment of **Sidney Gerhard** as chief engineer, **Propulsion Test Facilities,** New Haven, Conn., has been announced by **Norman G. Froomkin,** vice president and general manager. **PTF** is a division of **MB Electronics,** a division of **Textron Electronics, Inc.** . . . **Elwood Burgess, Jr.,** has been appointed production engineer for **United States Gypsum Company,** Chicago, Ill. . . . The appointment of **Andrew C. Dickson** to the post of chief manufacturing engineer for the **AP Parts Corporation,** Toledo, Ohio, has been announced . . . **John P. Riley** has been appointed vice president for development of **Lockwood, Kessler & Bartlett, Inc.,** Syosset, N.Y. . . . **Captain Lewis M. Davis** (U.S. Navy, ret.) has been named an associate in the firm of **Robert A. Willgoos and Associates** of Washington, D.C., and Alexandria, Va.

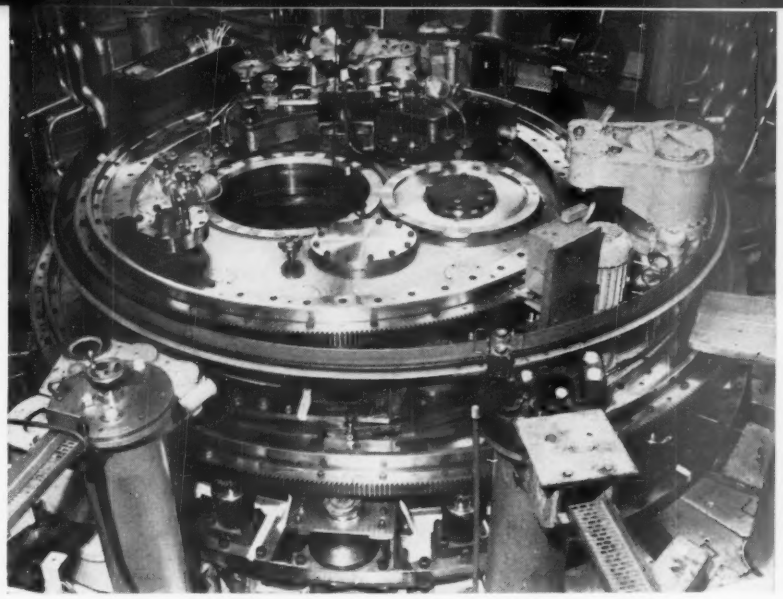
Mr. Gerhard

L. M. Clauson has been named chief engineer of the **Iowa Highway Commission,** succeeding **John G. Butler** who has resigned after forty years of service in highway work. **R. M. Tutton** has been appointed assistant chief engineer . . . **The American Bitumuls and Asphalt Company** has announced the appointment of **Robert M. Ripple** as technical service engineer for the Cincinnati, Ohio, district . . . **L. C. Skinner,** president of **Piping Engineering Company,** Tulsa, Okla., has announced the appointment of **H. K. Abernethy** as chief engineer and general manager . . . **Francis K. McCune** has been appointed vice president-engineering services for the **General Electric Company,** with headquarters in New York City . . . The appointment of **Robert Henderson** as chief engineer of **Hyster-Sonnerdale Ltd.,** distributing organization for **Hyster** equipment manufactured in Australia, has been announced . . . **Research-Cottrell, Inc.,** Bound Brook, N.J., announces the appointment of **A. B. Walker** as assistant director of research and development . . . **George A. Wesson, Jr.,** has joined the research, engineering and development staff of the **American Well Works,** Aurora, Ill.

Mr. Abernethy

A. T. Fragomen has been named manager of the Erection Department of **The Babcock and Wilcox Company's** Boiler Division, Barberton, Ohio . . . **William Bournias** has been named chief engineer of **Buhr Machine Tool Company,** Ann Arbor, Mich. . . . **Edward C. Finnegan** has been appointed field engineer for the Indianapolis, Ind., territory of **The Master Builders Company,** Cleveland, Ohio . . . **Richard T. Richards** has joined **Burns and Roe, Inc.,** New York City consulting engineering firm, as a supervising civil engineer . . . **Captain Robert S. Camera** (U.S. Navy, ret.) has joined **Piasecki Aircraft Corporation,** Philadelphia, Pa., as executive engineer . . . The appointment of **Bernard W. Peterson** as resident gas turbine installation engineer for **The Garrett Corporation,** Geneva, Switzerland, has been announced . . . **Joseph F. Koenen** announces the establishment of his office as a consulting civil engineer in Arlington Heights, Ill., a Chicago suburb . . . Two Tulsa, Okla., engineering firms—**W. R. Holway and Associates** and **Cornett, Wood and Associates**—have merged to form **Holway Engineers, Inc.** . . . **James R. Quinlan** has been promoted to an associate in the firm of **Fred S. Dubin,** consulting engineers of Hartford, Conn.

Mr. Finnegan



Here is the top of the fast breeder reactor at Dounreay, the United Kingdom Atomic Energy Authority's Experimental Reactor Establishment in the North of Scotland.

Aims—and Results—of Nuclear Reactor Research in Britain

REACTOR research has a very well-defined objective—namely, to make it possible to produce more and more power, either as electricity for powering factory machines and homes, or as mechanical power for propelling ships and, possibly, aircraft; and to enable this power to be produced as cheaply as possible.

In Calder Hall we have a commercial-scale reactor system, drawing its energy from the fission of uranium, which is actually working: there are, in fact, five reactors already feeding power into Britain's national electricity grid system and there are three more nearing completion.

At present there are in Britain four nuclear power stations under construction by consortia of industrial firms, working under contract for the electricity authorities. These stations, and others like them, will be coming into operation in the early 1960's, following the eight Calder Hall type reactors. Like the Calder Hall reactors, they are of a type described as gas-cooled and graphite-moderated—a type which extensive research by the United Kingdom Atomic Energy Authority, working in cooperation with British industry, has shown to be successful for immediate needs, and promising for future development.

Even now, this type of power station is known to be capable of producing electricity at a price only slightly above the price of that obtained from conventional power stations, provided that the station can run almost continuously, that is, at a high load factor.

But, as more nuclear stations are built, some of them are going to have periods of reduced production, due to the normal variation of demand between night and day, and winter and summer. This fact poses a big problem, since nuclear stations are expensive to build compared with conventional stations (about £130 [$364] per kilowatt of output, as against about £55 [$154] per kilowatt), and periods of idleness or low load are costly. The principal research problem therefore resolves itself into finding ways of designing and building cheaper stations.

This is being tackled in two ways in the United Kingdom. One way is by developing the proved gas-cooled, graphite-moderated type of reactor towards higher operating temperatures, higher rates of heat release and longer fuel life, and the other is by investigating alternative systems which show promise for the more distant future.

Let us look at just one of the problems involved, namely the development of the gas-tight container of "can" which encloses each one of the hundreds of uranium fuel elements in a reactor. During the early operation of the Calder Hall reactors a few can failures were observed—a few cans out of thousands were found to have developed tiny leaks, which could cause the release of small amounts of radioactive fission products.

The faulty elements were removed and investigated, and the fault traced to an insufficient degree of "give" or stretch in the

The author of this article is Dr. T. A. Hall, a member of the United Kingdom Atomic Energy Authority's Research Establishment Technical Secretariat.

"Magnox" metal cans. Research into this condition led to the development of a much finer-grained form of "Magnox," with superior stretching properties, more suitable for withstanding the thermal and mechanical strains to which fuel elements are subjected.

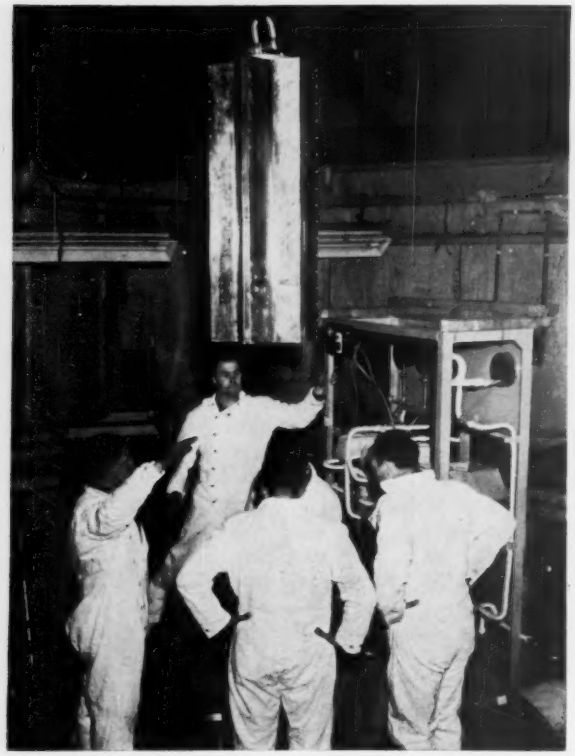
However, as soon as we consider raising the operating temperature of our future reactors substantially, we find that this development is no longer any use, because "Magnox" ceases to be suitable in any form, and we must turn to a new metal, and devise, again with much careful research, a canning technique which will give adequate gas tightness and resistance to deformation and corrosion. In the case of the Advanced Gas-Cooled reactors (A.G.R.) expected to come into operation in the late 1960's, the can will be of beryllium metal, and the fuel itself, on account of the higher temperature, will be uranium oxide instead of uranium, bringing a host of new problems in ensuring that the fuel does not change its shape or size during its operational life.

These problems, and very many others will be solved with the building and operating, by the United Kingdom Atomic Energy Authority, of two new reactors, whose construction is just beginning. These are a low-energy version of the A.G.R. design, known as "HERO," and the first large-scale A.G.R. itself. The great advantage of the low-energy version is that its radio-activity remains low, and scientists and engineers are therefore able to ring the changes on its detailed structure, and thus arrive at an optimum design. The full-scale version will enable engineering factors, fuel life and other matters to be studied.

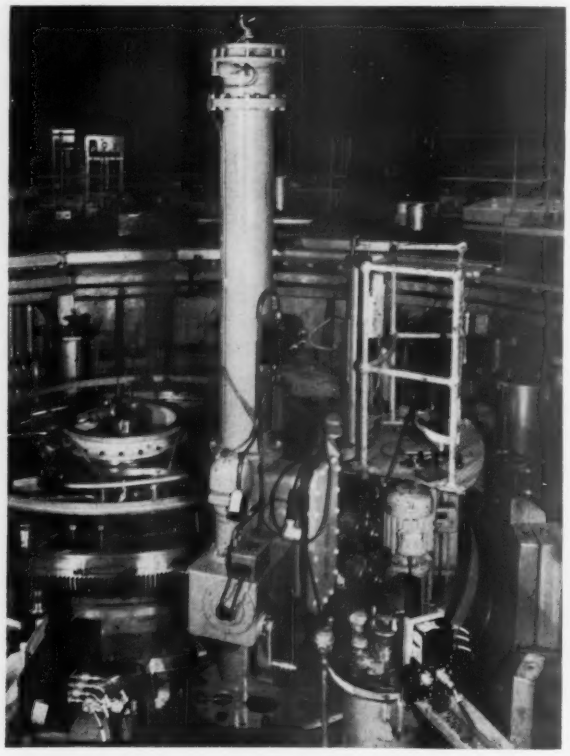
If we look ahead further than the A.G.R., well into the 1970's, we find ourselves faced with a choice of several systems which will require an enormous amount of research to resolve. For example, there is an even higher temperature version of the A.G.R. to be considered, known as the High Temperature Gas-Cooled Reactor. This is the reactor which is to be designed and built at Winfrith Heath in England as a joint venture between Britain and the Organization for European Economic Cooperation.

The Atomic Energy Authority is always reviewing the possibilities of other quite different systems, since one of the fascinating things about research is that nobody is ever quite certain where it will lead, and new discoveries might quite suddenly open up unexpected possibilities.

We are also interested in the application of nuclear energy to ship propulsion, although this is rather further off from the economic point of view, and is of less importance to us as a nation than an abundant and cheap electricity supply.—**End.**



A section of the inner core is here seen being lowered into the fast breeder reactor at Dounreay, the United Kingdom Atomic Energy Authority's Experimental Reactor Establishment.



A view of the reactor showing special equipment in place for the removal of a component from the reactor vessel during the commissioning period.

An Educator Views the 'Technician Problem'

Mr. Wade

By

JOHN S. WADE, JR., P.E.

Chairman, Engineering Division
Middle Tennessee State College

As a teacher of both engineering and industrial arts students at a publicly-supported state institution, I would like to put forth a few comments on the "technician problem" now facing our nation.

We, in the field of technical training, do feel gratified that the need for a more substantial program has been recognized. We have long been in sympathy with the plea of the employer for more and better candidates for technical positions at the subprofessional level. It is difficult, also, to be unaware of the struggle for the control of the funds that the Federal Government is allocating for technical training. I think it is possible to predict the usefulness of such funds in the hands of the crafts-oriented administrator and the engineer-oriented administrator.

The craftsman will probably impose objectives that may be attained by trainees under their guidance without much difficulty. The curriculum will emphasize job performance rather than understanding; thereby, duplicating to a large extent training provided by the actual work experience. Academic study in math and science is likely to be immature. Such a program will no doubt produce numerous diplomas, but not top-grade trainees for the really critical positions.

On the other hand, an engineering administrator's program would probably be designed to meet the required qualifications of a useful technician trainee, especially as defined by the engineering profession. However, if it is expected to utilize work-inexperienced high school graduates for the bulk of its enrollees, it will not improve the technician-engineer ratio by very much. The problem here requires only a rudimentary analysis of the high school graduate.

Unfortunately, there are few high school graduates who are willing candidates for training at the subprofessional level, and are, at the same time, competent for such a program. The student who is successful in formal mathematics and science looks toward the professions and a position of leadership. He is definitely not interested in the prospects of a secondary role as a "hireling" technician. The student who is unsuccessful in such subject areas is certainly a poor risk for the rigors of the technical institute, regardless of the career he fancies. After all, he has been patently avoiding just such a curriculum throughout his public school education. To throw more public funds in his direction would be a highly inefficient maneuver. It has been my continual observation in dealing with high school students that no promising individual will ever admit to planning a career as a technician.

I ask then, that we discard the high school as a primary source of material and go on to more fruitful resources—the labor force of the employers.

If we examine statistics and reports concerning individuals currently classified as technicians, we will find that many of them had little formal education for their current specializations in continuum. Their educational histories indicate that formal courses were undertaken by correspondence or in adult night classes, as the need for related information arose. Many of these people have become indispensable through this seemingly haphazard method of training. Why not direct the available appropriations toward the training of work-seasoned, willing, available individuals like these?

A sensible program can be inaugurated utilizing employers for the screening of applicants for scholarships. Indeed, an arrangement with managements, industrial or otherwise that need technicians, could be worked out following the concept of the engineering cooperative scholarship program. The major difference would be Federal aid and limited Federal direction.

Many existing facilities that are largely ignored by national planners could provide worthwhile educational experiences. There is a state college available for such training in every corner of our country. They can provide close, personal relationships between employers and teachers; something that centralized technical institutes could not accomplish as effectively.

Therefore, if the law could be modified to allow the individuals that are the most deeply concerned with this problem, namely the employer, the trainee, and the teacher to come together and plan the program in each separate instance, the available appropriations would go much further.

Even though such training would not result necessarily in a particular official label, such as a certificate or a diploma, the objective this nation sets for itself would be met.—**End.**

Society Urges More Vigorous Stand Against Unionization

• Action Taken by NSPE Board in Wichita
• Other Winter Meeting Highlights Detailed

A more vigorous stand against unionization of professional engineers was adopted in a revision of NSPE's policies on collective bargaining at the Board of Directors winter meeting in Wichita, Kansas, last month.

At the same time, the Board went on record in favor of providing assistance to technicians who request help in preventing their unionization in areas where it might affect the performance of engineers.

The actions in the areas of labor policy were among the highlights of the Board's deliberations during the three-day session at the Hotel Broadview in Wichita. Other major action included:

- Approval of plans for the establishment of an Engineering Scholarship Board to administer an expanded scholarship program.
- Expansion of the Society's student chapter program.
- Establishment of three grades of engineering technicians.
- Approval of the printing of a major survey of fees for Federal engineering contracts. (See separate story.)

At a luncheon meeting on the second day, General A. M. Minton told the directors that "the next ten years may be the decade of decision for the engineering profession as we enter a breakthrough and massive surge in technological development. The next ten years can also well determine whether we will be, in 1970, a truly professional organization or a group of craftsmen with skills in putting lines on paper."

General Minton, who is director of civil engineering for the Air Force and a member of NSPE, said that "active and vigorous participation in society activities, a strong registration program, and a reasonable legislative plan are all essential ingredients of a strong professional engineer program, and I believe a strong professional development program is the greatest problem facing engineers in the space age."

Later, at a dinner meeting, a Federal Aviation Agency official told the Board that NSPE was gaining increasing recognition among Federal officials and agencies.

"You may be interested in knowing that the Federal Aviation Agency recognizes NSPE as an authority in the professional field, and welcomes the opportunity to exchange views with the Society in matters concerning the engineering profession," Joseph Tippets, director of the FAA's Bureau of Facilities and Materials said. Mr. Tippets said there also was a growing inclination, on the part of top engineers in Government, to encourage their engineering personnel to join and participate actively in NSPE and the technical engineering societies.

The revision of NSPE's Policy 27 on collective bargaining was recommended by the Engineers in Industry Subcommittee for the purpose of expanding on "why" the Society is opposed to unionization of professional engineers and to reaffirm earlier stands in "more positive and vigorous" language.

The new policy statement says flatly that "collective bargaining for professional engineers is in conflict with the basic principles of a professional individual."

The new policy also says:

"The individual responsibility and independent judgment required of a professional engineer are incompatible with the regimentation fundamentally inherent in unionization.

"Collective bargaining divides the members of the profession into hostile groups and promotes discord among members of the same profession.

"Constructive relations between professional engineers and man-

President Harold A. Mosher, left, talks with Murray Wilson, chairman of the Board of Ethical Review, and Guy M. Shelley, general chairman of the meeting, at the winter sessions of NSPE at Wichita, Kansas.

Prominent Officials at Winter Meeting

General A. M. Minton, director of civil engineering for the Air Force, was the speaker at a luncheon on the second day of the meeting.

A. C. Friel, chairman of the Committee on Engineering Technicians, announces plans to establish classifications for engineering technicians.

J. A. Doubrava, president of the Kansas Engineering Society, welcomes members of the Board of Directors to the winter meeting in Wichita.

agement and the full development of professional engineers can best be accomplished through programs in cooperation with all elements of the engineering profession.

"More than twenty years of experience and experimentation demonstrate conclusively that the individual engineer and the engineering profession are best served through reliance upon the professional concept of solidarity in service to the public welfare and avoidance of collective bargaining."

In an allied action, the Board approved a two-part policy statement on its concern with unionization of engineering technicians:

1. NSPE should provide all possible assistance to engineering technicians requesting help to prevent their unionization where it may adversely affect the performance of professional engineers.

2. In cases in which professional engineers are closely related to technicians in conjunction with union organizing efforts, NSPE should provide assistance to both groups jointly.

In adopting the statement, the directors explained that they felt NSPE should be concerned with possible unionization of technicians because of the close working relationship between the two groups and because of the possibility that the unionization of technicians could hinder the engineer in his professional activities. The Board also expressed concern that the unionization of engineering technicians might force professional engineers into collective bargaining groups.

On recommendation of the Committee on Engineering Technicians, plans were approved for three grades of engineering technicians: engineering technician in training, engineering technician, and certified engineering technologists.

Also discussed briefly was a tentative suggestion for the establishment of an "Institute for Certifying Engineering Technicans and Technologists" which would administer the certification procedure. A. C. Friel, chairman of the Technician's Committee, said it was his group's initial thinking that the institute members would be appointed by NSPE to include members from the fields of education, industry and from present engineering technician ranks. This proposal, however, was presented to the Board in the form of information and no action was taken.

The Board also approved a revision and a consolidation of Policies 26 and 28 into a single policy statement reaffirming and expanding on the Society's stand in favor of obtaining and retaining rights of professional engineers in all labor legislation.

In another action on policy, the Board authorized a rewording of a statement on Freedom of Employment recommended by the Employment Practices Committee.

(*Continued on following page*)

Private Practice

A report from the Functional Section of Engineers in Private Practice is presented to the Board by Alfred H. Samborn, chairman of the Section.

Board Given Detailed Survey By Private Practice Section

Average fees charged by private engineering consultants on Government projects are considerably lower than widely publicized cost figures, the Functional Section for Consulting Engineers in Private Practice told the NSPE Board of Directors at Wichita.

The report was presented to the Board as a summary of a detailed survey conducted by a special Task Force on Government Contract Relations headed by L. M. Van Doren, of Topeka, Kansas. The full report will be published and distributed to Congress and other interested persons.

In surveying projects with a total of more than $4.3 billion in construction costs, the Task Force found that the average fee for design was 2.95. Individual fees ranged from .5 to 14.7 per cent, the report said.

Engineering inspection services on projects totaling more than $495 million averaged only 2.19. Individual fees varied from .5 to 7.5 per cent of the construction cost.

Information for the survey was furnished by 118 firms on 1,464 engineering service contracts with seventeen different agencies and bureaus.

The report announcd five conclusions from the assembled information:

1. The average fees of private consultants are considerably lower than the figures widely publicized.

2. A common erroneous assumption is that the consulting engineer always receives a maximum fee based on a percentage of construction cost.

3. It is impractical to generalize on engineering fees as a function of construction cost for a specific project. Lump sum fees are generally more equitable to the Government and to the engineer.

4. By using private consulting engineers, the public pays for the services only when needed.

5. Private consulting engineers, motivated by a profit desire, constantly strive to minimize overhead and can adjust more quickly to changes in conditions.

As part of its recommendations, the report said that "economy and public interest" should determine whether engineering service should be furnished by private consultants or engineering personnel in Government agencies.

The report also recommended that:

Governmental agencies should be responsible for preliminary study preplanning, and budgeting, and essential supervisory management and control with private consulting engineers handling design and other engineering services to the extent consistent with the best interests of the public.

Congress should avoid general limitations on engineering service fees.

Congress should extend and update the 1955 Task Force Study by the Hoover Commission to indicate the current costs of engineering services performed by Governmental agencies.

In a joint statement, the Functional Section for Engineers in Private Practice and the Functional Section for Engineers in Government Practice reaffirmed NSPE's position that "engineers in government and private practice recognize a need for engineering activities of a complementary nature." It further stated that:

"Professional engineers in government employ should perform the highest quality engineering services for preliminary study, preplanning and budgeting and essential supervisory management and control of governmentally-funded activities. Governmental agencies should contract for engineering services with highly qualified private engineering consultants to the extent consistent with national security, proper continuity of governmental programs and the public interest."

(Continued from page 43)

The new statement reads in part:

An individual professional engineer has the right to seek and accept other employment in his field, provided the seeking and acceptance of such other employment is consistent with the Canons of Ethics and the NSPE Rules of Professional Conduct as it pertains to relations with clients and employers. NSPE looks with disfavor on any provisions in contracts, or conditions of employment which limit the individual's choice of employment.

The directors adopted a set of recommendations proposed by the Student Chapter Committee which will allow an expansion of student chapter programs affiliated with the National Society.

The new program provides for three types of student chapters with these requirements:

Alpha Student Chapter—Shall be in a college of engineering having a curriculum or curricula of at least four years duration accredited by the Engineers' Council for Professional Development.

Beta Student Chapter—Shall be in a school or college of engineering having a curriculum or curricula of at least four years duration leading to an engineering degree.

Delta Student Chapter—Shall be

Student Chapters

J. Neils Thompson, chairman of the Student Chapters Committee, outlines plans for the expansion of his committee's program.

J. A. Doubrava, left, president of the Kansas Engineering Society, talks with NSPE Vice President Noah Hull following the banquet meeting of the Board.

in a school, college or junior college having a curriculum or curricula of at least two years duration designated as being preparatory for engineering courses in a school or college granting an engineering degree.

Requirements for the affiliation for the Alpha chapters are essentially the same as the present requirements for all student chapters. The Delta and Beta chapters, with somewhat lesser requirements, will be new additions to the national program. The net result will be an expansion of the program.

The Board also approved recommendations that the entire program of professional development of students be centered in a single committee using a title such as "Student Professional Development."

The Board gave its approval to plans for the expansion of the Society's scholarship program. The Society is currently cooperating with the Armco Foundation in the awarding of five $3,000 four-year scholarships to high school seniors. The new program would be extended along similar lines.

Tentative plans call for the expanded program to be administered under an "Engineering Scholarship Board."

The Board of Ethical Review presented decisions in three cases which the directors approved for printing. The cases cover the subjects of advertising, preferential treatment of building materials, free engineering, conflict of inter-

(Continued on page 56)

Thoughts on Professionalism...

By PAUL H. ROBBINS, P.E.

NSPE Executive Director

Engineers and the 1960 Census

In April of this year, the U.S. Bureau of the Census will attempt to record all individuals in the United States as well as pertinent information concerning many of them. While Census enumerators will secure from each individual such items as age, sex, race and similar information, detailed information on population characteristics will be secured from every fourth household. The secured material will be extended to give statistics for the entire population and will have many breakdowns from which much information concerning the population as well as the environment in which it lives may be secured. Thus, information on 15,000 readers of the AMERICAN ENGINEER may be expected to be recorded in the Census.

Of particular interest to the engineering profession, however, is question No. 27 to be answered by each member of every fourth household. This question has several parts but pertains primarily to his occupation. Unfortunately, delineation of the kind of work done by the individual must still be left to the individual filling out the form. The five questions which will have bearing on the ultimate tabulation of the number of engineers in the nation are the following:

1—For whom did he work?

2—What kind of business or industry was this?

3—Is this primarily: manufacturing, wholesale trade, retail trade, other (services, agriculture, government, construction, etc.)?

4—What kind of work was he doing?

5—Type of employment? (Such as employee of private company, government employee, or self employed.)

The key to the tabulation of engineers will be the answers given to the fourth of these questions; namely, "What kind of work was he doing?" This is exactly the way the question is asked, and there is a blank line following this question below which is given: (For example: 8th grade English teacher, paint sprayer, repairs TV sets, grocery checker, civil engineer, farmer, farm hand). It can be exected, of course, that there will be great variation in the replies which will be received in answer to this question. The Census Bureau has been, and will continue, doing an extensive job of training those who will be required to transfer this information to the IBM system which will ultimately be used for tabulation. Unfortunately, there will of necessity have to be many decisions made as to the general heading under which many of these replies will be recorded. It is to be hoped that diligence will be exercised that technician-type work and machine operators will not be recorded as technical engineers.

As far as members of NSPE are concerned, two items should be encouraged to the greatest degree possible: (1) All qualified members of the engineering profession should give clear and complete information so that they be recorded as engineers. (2) All members who are in a position to contact others responding to the Census should encourage them to answer this question accurately and, if they are *not* qualified as engineers, to use other wording which will place them in the appropriate Census listings.

Chipps to Leave This Month On Project Ambassador Tour

Project Ambassador will be launched on March 13 when Rodney D. Chipp and his wife, Dr. Beatrice A. Hicks, enplane in New York enroute to Rio de Janeiro, the first South American city they will visit in a four-weeks tour of that continent.

Working in cooperation with the leading professional engineering society in each country visited, the Ambassadors will hold a series of meetings with South American engineers, government and university officials, and businessmen to explore the less obvious problems in human relations that cause friction between South American engineers and United States engineers. This unique project has been undertaken by NSPE in an attempt to forestall any possibility of an "Ugly American" image in the exchange of engineering services between the two great continents of the Western Hemisphere.

In addition to assistance from the American embassies, it is planned that the schedule of activities by Rod Chipp and Bea Hicks will be coordinated by: in Brazil, the Federacao Brasilerira de Assocoacioes de Engenherios; in Uruguay, the Pan American Union of Associations of Engineers; in Argentina, the Centro Argentino de Ingenieros; in Chile, the Instituto de Ingenieros de Chile, and in Peru, the Sociedad de Ingenieros del Peru. In each country they will also visit as many outstanding engineering installations as their limited time will permit.

Upon their return, the Chipps will prepare a formal report of their tour, primarily concerning themselves with an analysis of the problems of social, economic, business, and cultural working relationships with which they were particularly impressed. This report will be presented to the NSPE annual meeting in Boston in June.

Officers Installed

The Nassau County Chapter of the New York State SPE recently installed new officers. Shown with the gavel is A.J. Giardina, incoming president. Leland Fitts, center, zone director, served as the installing officer. Clifford Dvorak, right, is the outgoing president.

W. Earl Christian to Speak in Pennsylvania

W. Earl Christian, Northeastern Region vice president of NSPE, will be the featured speaker at a regional meeting for all members of Pennsylvania's Beaver, Bucktail, Crawford, Erie, and Midwestern Chapters on April 9. Arrangements for the meeting are being made by Hugh M. Nelson, Pennsylvania national director, and Glenn L. Shorts, Pennsylvania vice president of the area comprising the five chapters.

In furtherance of NSPE's "grassroots" policies, the purpose of the meeting is to acquaint individual members of chapters in the region with national and state activities and objectives.

This Pennsylvania region has just concluded a successful "shirtsleeves" type meeting of chapter officers and secretaries, as well as legislative, public relations and membership committees.

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S. H. Taylor Dies; New Jersey National Director

S. Herbert Taylor, 58, an NSPE national director from New Jersey, died recently at Pennsauken, N.J.

He was a pioneer in the design and construction of drive-in theatres. From 1933 to 1948, he designed several hundred in thirty states. As former Camden County engineer, Mr. Taylor helped design part of the New Jersey Turnpike.

He was a founder and partner of Sherman, Taylor and Sleeper, consulting engineers of Camden.

Mr. Taylor was president of the New Jersey State Board of Professional Engineers and Land Surveyors, and a past president of the New Jersey SPE.

He is survived by his wife, two sons, and two sisters.

Dean Jett Dies

Daniel Boone Jett, a member of the New Mexico SPE, died in January. Dean Jett, as he was called, was head of the Engineering Department of the New Mexico State University for many years. He was a former secretary of the New Mexico Board of Registration for Professional Engineers and Land Surveyors.

B. H. Petty

Benjamin H. Petty, 71, well-known educator of Purdue University, died recently. He was a member of the Indiana Society of Professional Engineers.

Full-scale plans for the twenty-sixth annual meeting of the National Society to be held in Boston, June 8-11, at the Hotel Statler-Hilton are being prepared by Massachusetts SPE members. Shown, l. to r., are: convention chairman, Benjamin Mills, Jr., of Needham, Walter J. Kreske, of Newton, president of the State Society, and Donald C. Howard, of Newton, executive secretary of the Massachusetts group.

By Mrs. Garvin H. Dyer, Chairman of the Ladies Auxiliary Advisory Committee.

The Arkansas State Auxiliary reports that they have voted to use their project money to start a film library at the University of Arkansas for the promotion of the engineering field. A check was presented to the dean of the Engineering School of the University to start this library.

The San Jacinto Auxiliary of Texas was organized a year ago with fifty-three members. They now have 129. This Auxiliary is mostly social, aimed at helping chapter member wives to become better acquainted. They assist the parent chapter in many ways. Last spring they helped at the registration desk at the Engineering and Science Fair and this year plan to give a trophy in the auxiliary's name.

The Auxiliary of the Mercer Chapter of New Jersey sponsored its fifth annual poster contest at Trenton Junior College in connection with Engineers' Week. Prize-winning posters were displayed, along with engineering exhibits, in mid-city Trenton store windows during Engineers' Week.

The St. Louis Auxiliary is enjoying a very busy and interesting year, with many exceptionally good speakers for their luncheon meetings. One of the big events of the year is a scholarship fund card party at Famous-Barr Northland.

The Oregon State Auxiliary always has two fund-raising activities to support a very substantial scholarship. This year the events were a silver tea in October and a benefit fashion tea at which auxiliaries to the various branches of engineering were invited to decorate tea tables.

The Galveston, Tex., Auxiliary reports that their members saw a new film on "Industrial Russia" at a recent social meeting.

Plan NSPE Annual Meeting

Principal speaker John M. Ferry.

Mr. Ferry and D. C. Society President M. X. Wilberding.

Guest of Honor Major General A. M. Minton.

Air Force Program Outlined to D. C. Society

Civil engineering activity in the Air Force was outlined to more than 200 members of the District of Columbia Society of Professional Engineers and Air Force guests at a recent meeting.

Mr. John M. Ferry, special assistant for installations to the Secretary of the Air Force was principal speaker and outlined for Society members the subject, "Wanted: Engineers for a Multi-Billion Dollar Industry."

Guest of honor was Major General A. M. Minton, the Air Force's director of civil engineering. His immediate staff, as well as many members of his directorate were present.

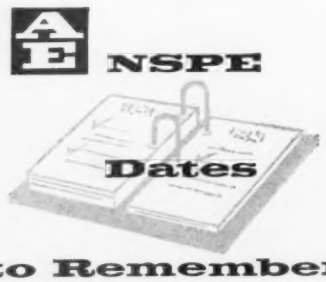
Mr. Ferry outlined the vast scope of activity for which Air Force Civil Engineers are responsible, including the maintenance and operation of more than 3,500 installations of varying sizes, requiring an annual expenditure of some three-quarters of a billion dollars. "New construction cost per year has been in the neighborhood of $1 billion," he also pointed out, "and the Air Force has housing valued at over $1.5 billion.

"The very nature of this huge operation works against us," he explained. "Because it is big, we need many people. Because it is world-wide, we must send our people over the globe to all sorts of stations. Consequently," he pointed out "many professional people leave the service because they prefer a more settled life. Additionally, we lose many of our engineers to private industry because it offers more attractive immediate salaries, stability, and often rapid advancement," he continued.

Mr. Ferry called upon the Society for assistance, saying, "we would welcome your suggestions on what sort of training we should offer young professional engineers who come into the service, and how we can make the service career attractive enough to hold the young men who are now coming in after graduation, staying only a few years, then going to industry."

The effort being made by the Air Force's Directorate of Civil Engineering to raise the professional competence and stature of its engineers was cited by Mr. Ferry. "In 1958," he said, "we had 86 registered professional engineers in the headquarters. In 1959, 112 had registered, or an increase of some 30 per cent. In 1958, there were 13 applications for membership to professional organizations, and in 1959 there were 61, an increase of 369 per cent. In 1958, we had only 89 members of professional engineering societies, and in 1959 an increase of some 70 per cent to more than 150 members." Figures for the engineers in the field are not available, but the trend is similar, he said.

Prior to Mr. Ferry's talk, General Minton and his deputies were introduced. General Minton gave a brief explanation of the magnitude of the Air Force civil engineering program. Deputies introduced were: Brigadier General R. H. Curtin, deputy for real property; Brigadier General K. K. Kelley, deputy for construction, and Colonel E. V. N. Schuyler, deputy for facilities support.



to Remember

Ohio Society of Professional Engineers—Annual Meeting, March 24-26, 1960, Netherland Hilton Hotel, Cincinnati, Ohio.

NSPE State Presidents' Conference—April 8-9, 1960, Memorial Union, Purdue University, Lafayette, Indiana.

Florida Engineering Society—Annual Meeting, April 20-23, 1960, Americana Hotel, Miami, Florida.

Wisconsin Society of Professional Engineers—Annual Meeting, April 21-23, 1960, Northland Hotel, Green Bay, Wisconsin.

New Jersey Society of Professional Engineers—Annual Meeting, April 29-30, 1960, Ambassador Hotel, Atlantic City, New Jersey.

National Society of Professional Engineers—Annual Meeting, June 8-11, 1960, Statler Hotel, Boston, Massachusetts.

TEACHING

(Continued from page 22)

is needed to help young engineers continue graduate study. He points to recent programs by the Ford Foundation, the Alfred P. Sloan Foundation, and the National Science Foundation as moves in this direction.

A survey of 235 former teachers who have left the campus for industry was published in a recent issue of the *Journal of Engineering Education*. The survey's figures on salaries of the group clearly pointed up the substantial differential between education and industry. Annual salaries of the 235 averaged $5,800 in teaching ($7,650 when extra income for summer jobs or consulting was added) compared with an average of $9,800 for the new jobs they accepted in industry.

And many of the group (195) indicated that they hoped to return to teaching. They said they hoped to do this after gaining considerable practical experience or "when I can afford to return."

One of the most complete studies of the engineering faculty problem was published by the Committee on Development of Engineering Faculties of the American Society for Engineering Education in 1958. It analysed and projected the problem over a ten-year period from 1957 to 1967. It came up with these major conclusions for the period:

- Undergraduate engineering enrollment is expected to increase by sixty-six per cent to approximately 414,000.
- Enrollment for the master's degree in engineering is expected to increase by ninety-three per cent to about 44,000.
- Enrollment for the doctorate in engineering is expected to increase 115 per cent to about 6,500.
- The number of engineering teachers is expected to increase by seventy-six per cent to about 16,000.
- If engineering teachers' salaries are to be competitive with nonteaching engineering opportunities, the average engineering teacher will earn $12,500 a year from teaching in 1966-1967, an increase of 105 per cent.
- To achieve this average salary, the total salary bill for engineering teachers in 1966-1967 will amount to about $200 million, an increase of 233 per cent.

Engineering schools may have to almost triple their total outlays for salaries if young students like this one are to find adequate and qualified faculties in the late 1960's.

Considering these figures, the problem is obviously a large one not only in terms of the present, but of the future. It will almost certainly take a greater public awareness and interest in education, if these institutions are to cope with the increasing demands of quantity and quality.

In a foreward to the ASEE report, Dean Harold L. Hazen of MIT wrote these comments:

"The problem of technological education—while deeply felt by a few—has yet to enter the public consciousness with the conviction essential to success. The heart of that problem is this: We must make careers in scientific and engineering education genuinely attractive to our first-rate minds – to enough of them to staff our engineering colleges with nearly twice their present faculties by 1967, at about three times the present salary bill.

"And we must become convinced that good education is worth this." **—End.**

Opportunities for research and an exchange of ideas with fellow members of the academic community are some of the attractions which help keep top engineering brains on the campus.

RICKOVER

(Continued from page 34)

position of the professional man in western civilization.

The Greeks founded the first true profession and the science which belongs to it—medicine. They formulated the professional ethics of this profession in the famed Oath of Hippocrates which we have not been able to improve upon. Young doctors embarking on their careers still swear this oath. Its fundamental creed of obligation and responsibility is basic to all subsequent professional codes. All are adaptations on what the Greeks originated.

In this country we have gone far towards cutting ourselves off from the broad stream of western culture. Rome and Athens are not for our children. Ancient history is supposed to bore them. So they are taught the essence of democracy by joining "smoke abatement campaigns;" they are shown the utility of simple arithmetic by paying a visit to City Hall to watch the clerks at work. As for learning the languages of the founders of western civilization, Heaven forbid! Far more useful is it to teach our youth how to drive an automobile and take its motor apart.

I am going to fly in the face of the opinions of all sorts of self-appointed experts on the needs of modern man by urging that in your spare time you make the acquaintance of the ancient Greeks and Romans – remarkably stimulating people and good company, I assure you. And as a guide to engineering ethics, I should like to commend to you a liberal adaptation of the injunction contained in the Oath of Hippocrates that the professional man do nothing that will harm his client. Since engineering is a profession which affects the material basis of everyone's life, there is almost always an unconsulted third party involved in any contract between the engineer and those who employ him—and that is the country, the people as a whole. These, too, are the engineer's clients, albeit involuntarily. Engineering ethics ought therefore to safeguard their interests most carefully. Knowing more than the public about the effects his work will have, the engineer ought to consider himself an "officer of the court" and keep the general interest always in mind.

Since the engineer deals with metals and fuels of which the earth has but a limited supply, it will make a great difference to future generations whether or not he is fully conscious that every ounce of metal or fossil fuel he uses means a diminution of nature's capital stock we bequeath to our descendants.

Engineers build structures which alter man's supply of pure air and water, of food and soil. A poorly designed factory may poison air and water; a dam or highway may needlessly rob our grandchildren of good farm land which by then may well be in short supply. Almost everything the engineer does has an effect on our materials base. His work is seldom purely an engineering task, though he sometimes acts as if it were.

For example, not long ago a bridge was being built across a body of sea water with valuable oyster beds. A small change of location would have saved the oysters. When this was pointed out by a marine biologist, the engineer in charge of building the bridge rejected the advice out of hand with the contemptuous remark: "What do you know about building bridges?" An irrelevant and rude reply. More to the point would it have been to ask the engineer: "What do you know about building bridges in this particular locality?" In this instance the livelihood of a number of people not in any way involved with the bridge or with hiring the engineer was adversely affected.

To give you another example I am familiar with: the design and operation of nuclear power plants. These involve questions of public health and safety which go far beyond those encountered in conventional power plants. For this reason we use every conceivable talent that can help in the design. And when the design is completed, it is gone over in detail by a committee composed of outstanding specialists in many technical areas. These men who are full-time professionals in their respective fields advise the Atomic Energy Commission on the safety of proposed reactor plants. Since reactor safety is a broad problem requiring knowledge of many subjects the members of this committee are selected not alone for their knowledge of reactors but because of their demonstrated competence in relevant areas such as meteorology, oceanography, nuclear physics, mechanical, electrical and chemical engineering, sanitary engineering, design of pressure vessels, explosives, industrial insurance, and so on.

Consultation with other experts ought to become as common in engineering as it is in medicine. A Venetian medical code of about 1500 A.D. made it mandatory for a physician to consult a colleague before prognosing a serious disease. Yet medical mistakes affect only one person, the patient; engineering mistakes can affect multitudes.

In recent years a profound transformation has taken place which has gone almost unnoticed by most Americans but which must strike any engineer forcibly. It is that we have ceased being one of the world's richest countries in mineral and fuel resources and a great exporter of raw materials. Indeed, we are now importing many vitally needed materials; we are, in fact, truly self-sufficient only in molybdenum and magnesium of the thirty-two indispensable minerals.

While our resources base has shrunk, our population has soared. In 1750 there were but 1.6 million Americans. During the next two hundred years we multiplied one hundred fold. Even with immigration substantially ended we are now growing at an annual rate of 1.8 per cent which, if you know your geometric progressions, would bring us to 5.3 billion by the year 2150—a thirty-five fold increase in the two hundred years after 1950.

As I see it, the most important aspect of the engineer's code of professional ethics ought to be the obligation to do nothing that will unnecessarily aggravate future resources deficiencies. To my mind his greatest task is to do everything he can to preserve opportunities for a good life to coming generations who will not be as rich

in land and resources as we are today. This means, in particular: no needless waste of irreplaceable materials; no permanent destruction of good soil or of our shrinking water resources merely for the sake of immediate advantages; it means utmost ingenuity in substituting abundant materials for scarce materials, renewable resources for irreplaceable resources. For example, in our nuclear propulsion program we are currently working to eliminate the use of a scarce gas, helium, for testing purposes by substituting a more abundant gas. When one is alert to the problem, many ways to save our resources capital will suggest themselves.

Greatly improved education for all and ingenious use of technology will help to offset diminishing land, mineral and fuel resources. We have only to look at Europe to see what can be done. There a high standard of living is being maintained on a modest resources base.

Switzerland, for example, has only one-fourth as much land per capita as we have, yet she manages to produce a per capita gross national product more than half ours —and only one-third smaller than that of rich and empty Canada. Or, to put it another way. Switzerland has the same population density as India, and she has only rocks, water and scenery, while India has rich natural resources. Yet the individual Swiss citizen is seventeen times as wealthy as the individual Indian. Improved technology brought about by educational investment in people is the secret of Switzerland's productivity and high standard of living. And technology is the engineer's metier. His is potentially the most important profession because the future well-being of all people may well depend on the manner in which he practices it.—**End.**

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CONSTRUCTION

(Continued from page 29)

complete installations are issued and, from these, the working drawings for structural, mechanical, and electrical work are developed. Frequent conferences are held with the client's engineer. Conference notes listing all decisions arrived at are circulated promptly through all departments and sent to the client.

With the work well underway, the project engineer now plays the role of coordinator, in addition to directing the detailed engineering performed by his assistants within his division. The efforts of all of the other engineers, the drafting room, and the construction department must be integrated. If the construction, engineering, and drafting schedules could all be adhered to exactly, this coordination would be assured. An engineer's life is seldom that easy, however, and the best laid plans will sometimes go astray.

Delays in receiving information from manufacturers may threaten to postpone vital parts of the design work. When this happens, a large reservoir of experience on similar installations is invaluable. Structural steel, for example, can be ordered from the mill from design drawings that were prepared with manufacturers' drawings of only two pieces of equipment on hand—the boiler and the turbine. The weights and dimensions of the myriad number of auxiliary equipment items are "guesstimated" from prints from previous jobs.

This procedure is justified, for a month lost in placing a mill order in recent years would ordinarily mean a month's delay in commercial operation, unless it is made up in expensive shift work in the field.

Second only to equipment costs, which are relatively fixed for a given installation, the most expensive component of power plant costs is field labor. Considerable engineering effort can be justified to make modest savings, in per cent, in field man-hours.

Precise scheduling of engineering, purchasing and construction is all-important. The construction

superintendent wants to handle heavy items of equipment only once. As major pieces arrive on the job they should move directly to their final positions. If this is to be accomplished, the structural supports must be in place and the sequence of delivery and erection must be worked out carefully in advance so as not to block the installation of later items.

Expensive temporary work can be avoided by proper scheduling. Temporary lighting is unnecessary if the permament lighting can be installed as soon as the building is closed in. Pipe hangers should be in place before pipe erection begins.

A smoothly run job does not just happen; it takes careful thought, continuous attention and complete cooperation on the part of every one assigned to the project.—**End.**

About the Author . . .

John J. Niland has recently been appointed assistant engineering manager at Stone & Webster Engineering Corporation.

Mr. Niland

Stone & Webster designs and builds power plants, petroleum refineries, chemical plants, nuclear facilities and industrial installations in various parts of the world.

Mr. Niland joined Stone & Webster in 1941 after having worked for the Boston Edison Co. Named design engineer in 1950, he was promoted to senior design engineer in 1953. Assigned to engineering administration in 1956, Mr. Niland has also served as assistant to the president of Associated Nucleonics, Inc., a subsidiary of Stone & Webster engaged in atomic energy work.

A native of Boston, Mr. Niland was graduated from Mechanic Arts high school in Boston and attended Massachusetts Institute of Technology, Tufts College and Northeastern University. He is a member of the American Society of Civil Engineers and a registered professional engineer in Massachusetts.

See AE's Readers' Service Department On Page 58.

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FOUNDATION

(Continued from page 32)

operated by these institutions with financial support from NSF. During 1959, NSF provided more than $33 million for these institutes.

Another area of importance for the engineer is the NSF's Scientific Manpower Information Program. Under this program, the NSF in cooperation with various scientific and engineering societies, maintains the *National Register of Scientific and Technical Personnel* which makes possible the quick location of specialized engineers and scientists in the nation. This division of NSF also conducts the Scientific Manpower Studies and distributes information on supply, needs and training of engineering and scientific personnel.

NSF also is carrying on a rapidly expanding program for the coordination of engineering and scientific information on a national basis. Most of this work is being carried out by the Office of Science Information Service established by NSF under the National Defense Education Act of 1958. In 1959, NSF made 146 grants totaling about $3.8 million for the furtherance of the exchange of engineering and scientific information. Part of these funds are directed to programs for the translation of foreign scientific and technical journals. In 1959, NSF participated in the translation of more than 70,000 pages of foreign information.

These are just a few areas of NSF activity which touches on the engineering profession. There are many other areas, particularly in basic research, in which the NSF is making either direct or indirect contributions to the promotion of the engineering sciences. True, some of the NSF programs are still in their infancy and are yet to make a big impact on the engineering and scientific community. But the very existence of such an organization as the National Science Foundation is evidence of the Federal Government's growing recognition of the contributions of engineering and science. The NSF almost certainly will play an increasing role in the coordination and promotion of these vital activities.—**End.**

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LETTERS

(Continued from page 4)

All too frequently, engineers make statements which would be more honestly put into these words without changing the meaning: "The engineers who have spent the past several months (years) examining and analyzing conditions and designing this project have no faith in their own judgment. All persons who bid thereon have three weeks in which to make their own independent determination of all conditions which will affect the work and must rely exclusively thereon, regardless of anything in the plans or specifications."

It is the writer's opinion that, because of the difficulty which frequently attends the obtaining of funds for adequate engineering study and analysis of conditions prior to design, engineers have found it simpler to throw much of the work which they should have done into the construction contract. If we are to be professional we must act in a professional manner. Would we like our doctors to say on the prescription blank: "The druggist must examine the patient, determine his symptoms, and prepare the medicine according to his findings."

BAYARD F. SNOW, P.E.
Miami, Fla.

Engineers in Government . . .

Dear Editor:

In reference to various comments in your September issue, especially regarding the fact that government service does not seem to attract as many top engineering graduates as does private industry, may I suggest that your issue itself contains part of the explanation. Several items, and I am thinking now of the TVA item on page 13 and the "Attack on Consulting Engineers" on page 27 reflect what is essentially a puzzling attitude, unfortunately common among engineers in private practice, of assuming that there is something automatically undesirable about the government doing engineering work. Whether this is due to a fear that such will lead to socialism, I do not know, but I do know that if this is the reason, it is without foundation.

How can you expect to serve professional engineers in the government service, and help to attract better engineers into the government service, when you are saying (between the lines) that you regard government engineering as wrong? You or the NSPE, obviously believe that private practice of engineering is more efficient, less costly, and more to be encouraged than that by the government. Whether this is true or not, how do you expect such an attitude to encourage the best men into government service? (By the way, I am not in the government service myself.)

RINEHART S. POTTS, P.E.
Pitman, N. J.

► **Editor's Note: The opening paragraph of NSPE *Professional Policy No. 7-a* as adopted by the Board of Directors reads: "NSPE believes that the Federal Government is entitled to, and should have, the highest quality of engineering services. . . ." The remainder of the Policy (and others) set forth in detail how important the Society feels the Government engineer is and, therefore, why he should be so treated. The *American Engineer* endeavors to edit *all* material against the backdrop of *all* adopted policies.**

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Massachusetts Leads Region

Massachusetts Director David Bashaw, right, gets congratulations for his State's leadership in membership in its region. At the left is President Harold Mosher and Tom Mann, chairman of the Membership Committee. Also receiving membership banners at NSPE's winter meeting were Oregon, Idaho, Mississippi, Maryland, and Washington.

MEETING

(Continued from page 45)

est, and the question of conduct in connection with the termination of one engineer's services and retention of a different engineer for the same work. The report of the cases will be presented in later issues of the AMERICAN ENGINEER.

Other action included approval of French Lick, Indiana, as the site of the 1962 annual meeting. Jackson, Mississippi, was chosen for the 1962 winter meeting and Phoenix, Arizona, for the fall meeting.

The Wichita Chapter of the Kansas Engineering Society was host for the meeting with Guy M. Shelley, president-elect of the KES, serving as general chairman. Other members of the meeting committee included D. D. Hook, general co-chairman; C. S. Clark, general co-chairman; B. J. Alberts, publicity; C. L. Trapp, printing chairman; Louis Montre, finance chairman; H. Rex Brunson, entertainment; Don C. Moehring, registration, and W. A. Wolfe, hotel chairman. Mrs. R. S. Delamater served as general chairman of the ladies program.

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Progress in Products

ELBOLIFT — Item 30

Automatic's new version "Elbolift," gas-operated electric-driven, provides a mastless industrial truck which obtains maximum fuel efficiency and economy plus being capable of moving heavy steel coils in and out of boxcars, yet able to stack 120 inches high. Two field proven units have been combined to give the maneuverability of the Elbolift and constant power, which supplies the exact amount of electric power to the drive motor through a variable voltage generator that is coupled to a gas engine.

MICROFILM PLAN — Item 31

A new microfilm package plan that combines a camera, film, Universal Processor, Uni-Kards, and reader has been announced by Remington Rand Division of Sperry Rand Corporation. Known as the Film-a-Record Micro-Station Package Plan, it actually constitutes a complete industrial and engineering microfilm department. It assures savings in space, time, and money while offering better protection for engineering drawings, it is claimed. The camera—the F36.1PL—is a power-driven, 9-position, planetary unit.

ELECTRICAL GAGES — Item 32

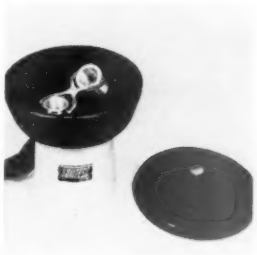
For fast, effortless inspection to present-day tolerances and for the employment of automatic devices guided by the gaging results, electricity is successfully used in transforming ordinary mechanical comparator gages into gaging units that indicate the passing of tolerances by flashing lights. Electric limit contacts built into the gaging unit will act with a finer discrimination than ordinary dial indicators and off-size conditions can be detected within twenty millionths of an inch accurately and instantly, it is claimed.

SAFETY DEVICE — Item 33

A warning buzzer to notify motorists when their cars are too close to the pavement edge has been recently demonstrated. Developed by Electronics-Instrumentation Department, General Motors Research Laboratories, the Electro Lane is analogous to the "beam" by which aircraft pilots maintain course from one airport to another. The Electro Lane is a simple low frequency (2 kilocycle) electro-magnetic device that is said to be installed easily in or beside any paved road at relatively low cost.

TESTING APPARATUS — Item 34

Soiltest, Inc., Chicago, has designed a new centrifuge kerosine equivalent apparatus (CKE) for measuring surface capacity, including absorption of both coarse and fine aggregates used in bituminous mixtures. The new apparatus is also used to determine an index (K factor) which indicates the relative particle roughness or degree of porosity. A protecting dome and cover of fiberglass surrounds the operating parts of the centrifuge. The dome is mounted on an aluminum circular base which also encloses the motor.



SKETCHING TISSUE — Item 35

A lightly-tinted yellow sketching tissue that permits low-cost reproduction is one of the newest product developments of Keuffel & Esser Co. Designed primarily as a "talking" paper—to make idea sketches and quick roughs—for architects, commercial artists and advertising agencies, the new #185 Sketching Tissue is an inexpensive paper that takes pencil, charcoal, or crayon equally well. It will produce sharp copies in standard diazo, blueprint and office copy machines.

INDUCTOR KIT — Item 36

A kit of high stability glass inductors has been developed by the Corning Glass Works primarily for use in prototype work. An infinite variety of inductances between .05 and 2 microhenries is made possible by the kit's tuning cores. A secondary purpose of the kit is to help designers gain an empirical knowledge of the properties of Corning's line of standard glass inductors. The kit includes 10 inductors, four tuning cores and a 50-page technical brochure.

EXPANSION JOINTS — Item 37

A new weather-resistant expansion joint which virtually eliminates cracking in the seams of terrazzo tile and concrete flooring has been developed by The Firestone Tire & Rubber Company. The new "Flex-Tite" expansion joints, utilizing a resilient rubber compound and metal, are designed to expand or contract with all seasonal temperature changes, thus eliminating cracking and crumbling at the seams, according to the manufacturer. Flex-Tite expansion joints, manufactured in long strips, are composed of a synthetic rubber compound bonded between strips of durable zinc.

This feature describes new products of general interest to professional engineers. For further information, circle the item number in the Readers' Service Dept. and mail to AMERICAN ENGINEER.

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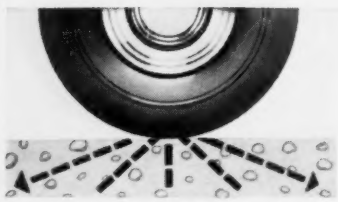

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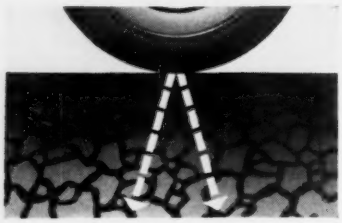

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